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CONTENTS

Volume 7, Number 2	Page
A new species of <i>Cassinia</i> R. Br. (Asteraceae) from South-West Victoria —N. G. Walsh.....	141
New taxa and a new combination in Tasmanian Poaceae —D. I. Morris.....	147
Some species of <i>Cladonia</i> , published by J. D. Hooker & T. Taylor from the Southern Hemisphere —Teuvo Ahti, Soili Stenroos & Alan W. Archer.....	173
The mycorrhizal associations of Australian Inuleae (Asteraceae) —J. H. Warcup.....	179
Notes on Australian Verrucariaceae (Lichenes): I —P. M. McCarthy.....	189
<i>Eucalyptus wimmerensis</i> , a new species of <i>Eucalyptus</i> (Myrtaceae) from Victoria and South Australia —K. Rule.....	193
Notes on <i>Hovea</i> R. Br. (Fabaceae): 4 —J. H. Ross.....	203
Two new species of <i>Pomaderris</i> Labill. (Rhamnaceae) from New South Wales —N. G. Walsh.....	207
A revision of <i>Trichanthodium</i> Sond. & F. Muell. ex Sond. (Asteraceae: Inuleae: Gnaphaliinae) —P. S. Short.....	213
A revision of the genus <i>Chthonocephalus</i> Steetz (Asteraceae: Inuleae: Gnaphaliinae) —P. S. Short.....	225
New taxa and new combinations in Australian Gnaphaliinae (Inuleae: Asteraceae) —P. S. Short.....	239
Two new species of <i>Callistemon</i> R. Br. (Myrtaceae) —P. F. Lumley and R. D. Spencer.....	253
<i>Haegiela</i> , a new genus of the Australian Asteraceae (Inuleae: Gnaphaliinae), with notes on the genus <i>Epalties</i> Cass. —P. S. Short and Paul G. Wilson.....	259
The <i>Pomaderris oraria</i> F. Muell. complex in Australia —N. G. Walsh.....	267
New species of <i>Hibbertia</i> Andr. (Dilleniaceae) in New South Wales, Australia —Barry J. Conn.....	289
A new species of <i>Acrotriche</i> R. Br. (Epacridaceae) from South-Eastern Australia —P. C. Jobson and T. Whiffin.....	295
New species of <i>Petrophile</i> R. Br. (Proteaceae) from Western Australia —D. B. Foreman.....	301
Book Review: How to know Western Australian wildflowers. Part 1. Restructured and revised. Second edition. —M. G. Corrick.....	311

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A NEW SPECIES OF *CASSINIA* R. Br. (ASTERACEAE) FROM SOUTH-WEST VICTORIA.

by

N. G. WALSH*

ABSTRACT

Walsh, N. G. A new species of *Cassinia* R. Br. (Asteraceae) from south-west Victoria. *Muelleria* 7(2):141–145 (1990).—*Cassinia rugata* sp. nov. is described and illustrated, with notes on distribution, habitat, conservation status and relationships to some other species of *Cassinia* and *Helichrysum*.

INTRODUCTION

When compiling a register of rare or threatened plants in Victoria, collections at the National Herbarium of Victoria (MEL) were examined for Victorian plant taxa which were poorly known or for which little contemporary information was available. Specimens of one such taxon, listed as '*Cassinia* sp. (Heathmere)' in Forbes and Ross (1988), were segregated from collections of *Cassinia aculeata* and *Helichrysum rosmarinifolium* and found to be uniform and distinct from both these species as well as other species in both genera.

Locality details on the specimens indicated that the undescribed species was known from a restricted area in the far south-west of Victoria and in March 1988, field-work in the area confirmed this and also suggested that the species was vulnerable due to the low number of individuals and its absence from any biological reserve. In order that the case for protection may be more successfully mounted, the opportunity is here taken to describe the new species.

TAXONOMY

Cassinia rugata N.G. Walsh sp. nov.

Frutex ad 3 m altum. *Ramuli* cristati per lineas decurrentes basibus et costatis foliorum, hispidi, juvenes gossypini. *Folia* sessilia, alterna, saepe fasciculata et/vel subopposita sub inflorescentiis; lamina crassiuscula, oblonga ad anguste-elliptica, 6–25 mm longa, 1.5–4.5 mm lata, margine recurvata, paginae superae scabra, secus costam impressam pubescentia, paginae infernae breviter lanata. *Inflorescentiae* corymbosae, paniculatae, plerumque 3–12 cm diametro. *Capitula* aggregata, cylindrica vel turbinata, 4–5 mm longa, 1.5–3 mm lata; bractae involucri in 5–6 seriebus radialibus, et in 4–5 seriebus longitudinalibus accedentibus dispositae, arachnoideae sparsim, interior 2–3 series apicibus erectae, firmae, albae, rugatae. *Flosculi* 4–7, cum 1–3 squamae receptaculi oblongae interspersae. *Achenium* cylindricum vel ovoideum, c. 1.2 mm longum, 0.5 mm latum, sectione plano-convexum, cum c. 6 cristae longitudinali, glabrum, sparsim viscidum-glanduliferum. *Setae* pappi 24–28, barbellatae, complanatiores et latiores ad apice.

TYPUS: Victoria—South-west. Heathmere area. Heathland beside Jennings Road, c. 1.2 km north from Surrey River crossing. 11.5 km due south from Sinclair railway siding. 38° 11' 30" S; 141° 33' 50" E. Victorian Plant Grid E 13. *N. G. Walsh 2074* and *A. C. Beaglehole*, 14.iii.1988. (**HOLOTYPE:** MEL 1560557. **ISOTYPE:** AD, HO).

Shrub to c. 3 m high. *Stems* ridged by decurrent lines from leaf bases and midribs, sparsely hispid, overlain by cottony hairs when young. *Leaves* sessile, alternate, often fascicled and/or subopposite shortly below the inflorescence; lamina thick, oblong to narrowly elliptic, 6–25 mm long, 1.5–4.5 mm wide, margins recurved, upper surface scabrous, downy along the impressed midvein, lower surface covered with white woolly hairs. *Inflorescence* a corymbose panicle, mostly 3–12 cm diameter.

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.



Fig. 1. *Cassinia rugata*. a—flowering branch, $\times 1$. b—leaf 3/4 view, $\times 4$. c—leaf from undersurface, $\times 4$. d—capitulum, $\times 12$. e—receptacular bract, $\times 15$. f—achene, $\times 20$. a-e from holotype, Walsh 2074 (MEL 1560558); f from Beaglehole 5677 (MEL 527146).

Capitula densely clustered, cylindrical to turbinate, $4-5 \times 1.5-3$ mm; involucre bracts obtuse to truncate, in 4-6 series, approximately ranked into 4-5 rows, sparsely cobwebby, the inner 2-3 series with erect, firm, white, wrinkled tips. *Florets* 4-7, interspersed with 1-3 oblong receptacular scales. *Achene* cylindrical to ovoid, c. 1.2×0.5 mm, plano-convex in section, c. 6-ribbed longitudinally, glabrous, sparsely viscid-glandular. *Pappus* of 24-28 barbellate bristles, flattened and broader toward the tips. (Fig. 1)

OTHER SPECIMENS EXAMINED:

Victoria—Drumborg, c. 18 miles NNW of Portland, 15.iv.1945, A. C. Beaglehole 481 (MEL 1560578); 0.8 km N of Surry River, swampy places, Gorae, 21.iv.1962, A. C. Beaglehole 5677 (MEL 527146); south-west Study Area, Cobboboonee Block, Boundary Road, 10.iii.1977, A. C. Beaglehole 55410 and C. & D. Woolcock (MEL 527127); approx. 11 miles NNW of Portland, and 5 miles west of Heathmere, 10.ii.1968, H. I. Aston 1655 (MEL 1560583); beside unnamed road, 7 km SW from Sinclair railway siding, c. 1 km S of Fitzroy R. ford, 14.iii.1988, N. G. Walsh 2076 and A. C. Beaglehole (MEL 1560555).

DISTRIBUTION AND CONSERVATION STATUS:

The species is apparently confined to an area of about eight km radius taking in the upper catchments of the Surrey and Fitzroy Rivers, centred on a point about 25 km NW of Portland in far south-west Victoria. Four populations are known, each from roadside vegetation, two sites being at the eastern fringes of the Cobboboonee forest block and the others being marginal to private property. None of the populations are contained within a biological reserve. The sizes of the populations are estimated to be between 20 and 100 individuals. The species conservation status is assessed to be 2Vi (Briggs and Leigh, 1989).

HABITAT:

The species occurs on seasonally wet, heathy sites, virtually treeless and typically with a dense shrub layer to c. 2.5 m high (one population occurred on a roadside verge virtually cleared of other vegetation, but remnant species indicated that the original vegetation was probably comparable to the uncleared sites). Typically associated species include *Allocasuarina paludosa*, *Baumea juncea*, *B. rubiginosa*, *Helichrysum rosmarinifolium*, *Juncus procerus* and *Pultenaea stricta*. The substrate at each site is derived from recent Quaternary siliceous sand (Malanganee Sand), enriched and blackened with peaty deposits from the wet heathland.

ETYMOLOGY:

The specific epithet is derived from the Latin *rugatus* meaning folded or wrinkled referring to the inner involucre bracts which are wrinkled toward their tips, a feature unique in *Cassinia*.

DISCUSSION:

The new species appears to be most closely related to *C. uncata* Cunn. ex DC., a polymorphic species with "several more or less distinct entities" (Cooke in Jessop & Toelken, 1986), but which differs from *C. rugata* in a number of features (see table). *C. uncata* is distributed from southeast South Australia, through drier areas across Victoria to the tablelands and western slopes of New South Wales. It is not known to occur within c. 100 km of the known sites for *C. rugata*.

Notes accompanying herbarium specimens (e.g. J. H. Willis and A. C. Beaglehole s.n. 20.iv.1970, MEL 504682) suggest that *C. rugata* may be an intergeneric hybrid between *Helichrysum rosmarinifolium* (Labill.) Benth. (which grows in the same community) and *Cassinia aculeata* (Labill.) R.Br. (which is not known in the vicinity), but *C. rugata* differs in a number of characters which are apparently not derived from nor intermediate in state between the proposed parent species (see Table 1). Mature seed of *C. rugata* removed from Beaglehole 5677, germinated and has proceeded, albeit slowly, to the 4-leaf stage, further suggesting that it is not a hybrid. The distinction between *Cassinia* R.Br. and shrubby species of *Helichrysum* [subgenus

Table 1. Comparison of *Cassinia rugata* with closely related species.

Species	leaf shape/ texture	stem vestiture	involucral bracts	receptacular bracts	achene	habitat
<i>H. rosmarinifolium</i>	linear, herbaceous apex straight	cottony	unranked- ranked, tips spreading, ±wrinkled	lacking	plano-convex in section glabrous, ribbed: pappus bristles flattened toward tips	swampy heaths
<i>C. aculeata</i>	linear, herbaceous; apex straight	bristly	unranked, erect, smooth	present	angular but not ribbed, with sparse, short hairs: pappus bristles not flattened toward tips	various, but not swampy heaths
<i>C. uncata</i>	linear, firm; apex recurved	cottony &/or bristly	ranked, erect, smooth	present	plano-convex in section, glabrous or sparsely glandular, ribbed: pappus bristles not flattened toward tips	drier sites and coasts
<i>C. rugata</i>	oblong to narrow elliptic; apex recurved	cottony & bristly	±ranked, spreading wrinkled	present	plano-convex in section, sparsely glandular, ribbed: pappus bristles flattened towards tips	swampy heaths

Ozothamnus (R.Br.) Lessing] is not always clear. The two are formally distinguished on the basis of the presence or absence of receptacular scales (only present in *Cassinia*). However, some entities currently included in *Helichrysum* (e.g. *H. bilobum* subsp. *scabrum*) possess receptacular bracts. It is possible that *Cassinia* and *Helichrysum* subgenus *Ozothamnus* may be united in the future. Both *Cassinia* and *Ozothamnus* were initially erected as genera in a preprint to the *Trans. Linn. Soc. London*, published before Sept. 1817. The priority of either name, should the two genera be amalgamated, is therefore unclear, so without wishing to preempt any decision on the future classification of the group, the new species is here included in *Cassinia* to which, in the narrow sense, it belongs, and which is a name in widespread use.

ACKNOWLEDGEMENTS

I am indebted to Mr A. Cliff Beauglehole of Portland for unerringly guiding me to the known populations of *C. rugata* (some of which he had not visited for c. 40 years!), to Mr David Cooke (Animal and Plant Control Commission, South Australia) for his comments in relation to South Australian forms of *C. uncata* and the new species, to Paul G. Wilson (PERTH) and my colleague Philip Short for valued advice, and to Anita Barley who prepared the illustration.

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NEW TAXA AND A NEW COMBINATION IN TASMANIAN POACEAE

by

D. I. MORRIS*

ABSTRACT

Morris, D. I. New taxa and a new combination in Tasmanian Poaceae. *Muelleria* 7(2):147–171 (1990). Eight new species *Agrostis lacunis*, *Danthonia diemenica*, *Danthonia nitens*, *Danthonia popinensis*, *Danthonia remota*, *Deyeuxia apsleyensis*, *Deyeuxia innominata*, *Poa jugicola*, three new varieties *Agrostis billardieri* R. Br. var. *collicola*, *Agrostis billardieri* R. Br. var. *tenuiseta*, *Poa poiformis* (Labill.) Druce var. *ramifer* are described and a new combination *Pentapogon quadrifidus* var. *minor* is made.

INTRODUCTION

The last comprehensive account of Tasmanian grasses was Rodway (1903). Subsequently *A species list of and keys to the grasses in Tasmania* was published by Townrow (1969). In the course of preparation of the section on the Poaceae for part 4B of *The Students Flora of Tasmania* a number of novelties emerged. As publication of part 4B of the Flora is still some time off, these taxa are described below to make the names immediately available. Under the 'distribution' headings the regions given are those in *A natural regions map for Tasmania* (Orchard 1988).

AGROSTIS L.

***Agrostis billardieri* R. Br. var. *collicola* D. Morris var. nov.**

A Agrostis billardieri R. Br. var. *billardieri* arista lemmatis subterminali tenui differt. *A Agrostis billardieri* var. *tenuiseta* D. Morris statura parvior (usque ad 15 cm altam), panicula parvior, spiculis paucis, in regionibus interioribus praesenti ad c. 800 m altitudinem differt.

TYPUS: Tasmania, Saddle between The Hippo and Moonlight Ridge Hill, c. 800 m altitude. Exposed situation with very little vegetation, 10 Feb. 1985, P. Collier 309 (HOLOTYPUS: HO 93165).

Differs from *Agrostis billardieri* var. *billardieri* in having a slender subterminal awn. Differs from *Agrostis billardieri* var. *tenuiseta* in its smaller stature (up to 15 cm high), smaller panicle with few spikelets. Occurs inland at c. 800 m altitude. (Figs. 1, 2a)

DISTRIBUTION:

Tasmania; Central Highlands, SW, known only from the type and from a second collection: Lake Ewart, 850 m, herb lawn on stream bank, 7 Feb. 1987, A. M. Buchanan 10071 (HO).

ETYMOLOGY:

Collicola, dwelling in hills, relating to habitat.

***Agrostis billardieri* R. Br. var. *tenuiseta* D. Morris var. nov.**

A Agrostis billardieri R. Br. var. *billardieri* arista lemmatis subterminali, tenui, infirma, stricta, usque ad 4 mm longam vel absenti differt.

* Tasmanian Herbarium, GPO Box 252c, Hobart, Tasmania, Australia 7001.

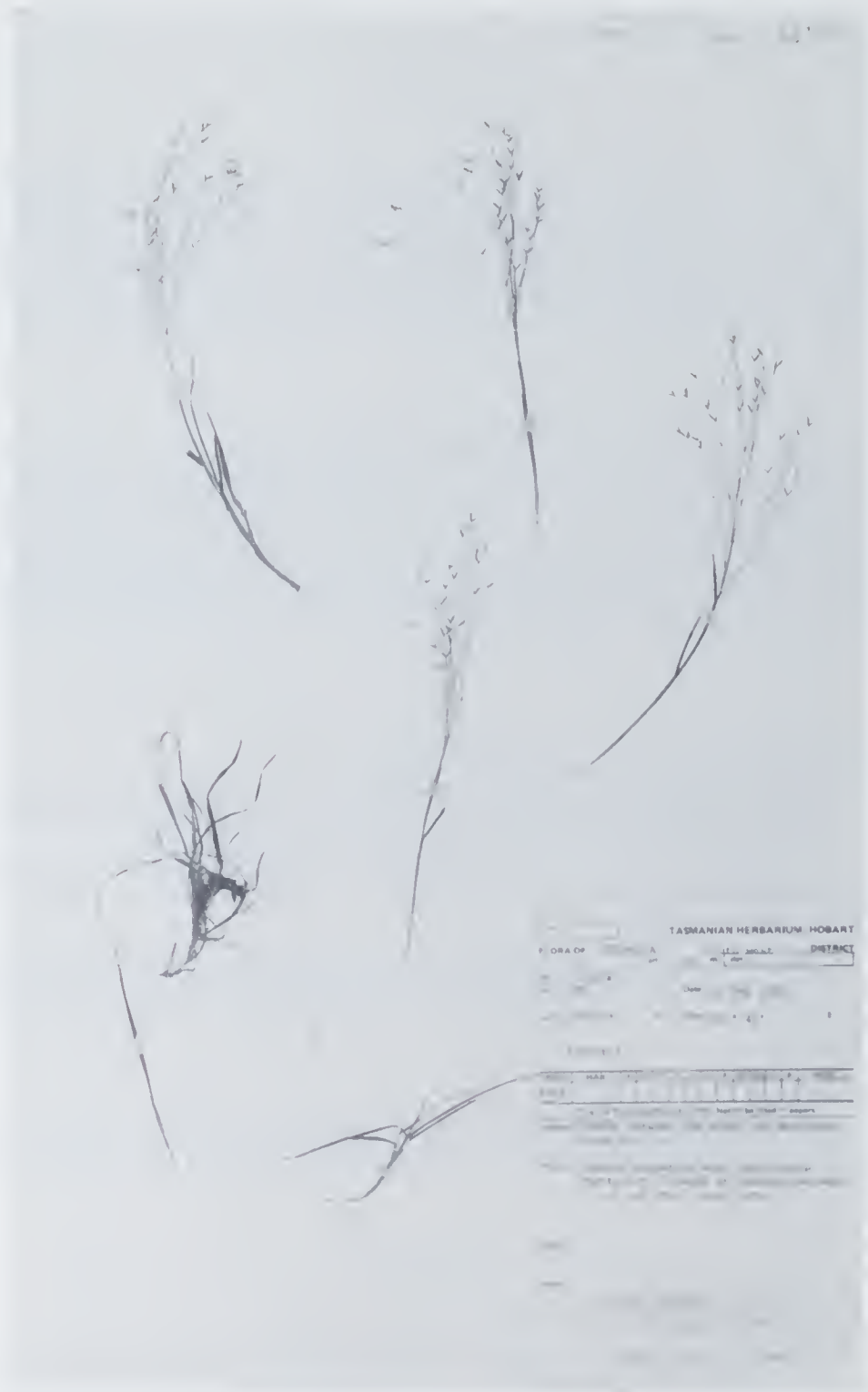


Fig. 1. Holotype of *Agrostis billardieri* var. *collicola*.

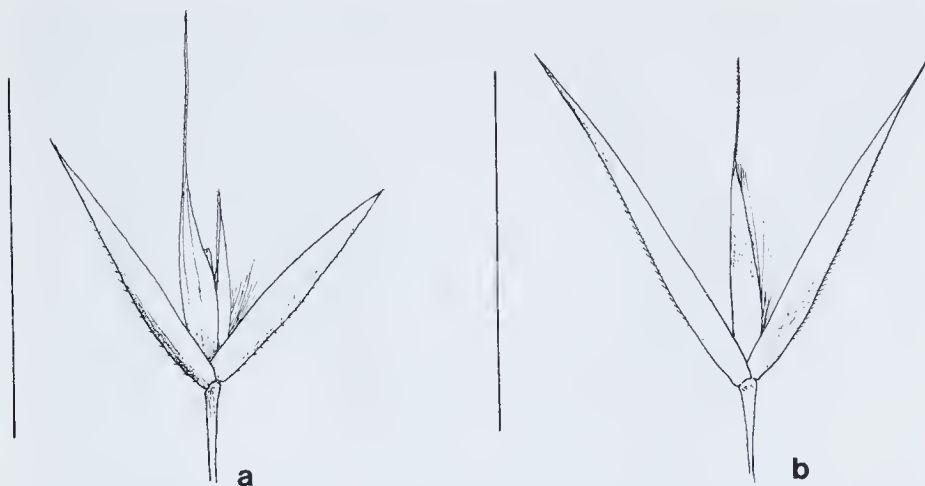


Fig. 2. a—Spikelet of *Agrostis billardieri* var. *collicola*. b—Spikelet of *Agrostis billardieri* var. *tenuiseta*. Scale lines = 5 mm.

TYPUS: Tasmania, Dolphin Sands, Nine Mile Beach, 3 m altitude, seaward face of frontal dune, dominated by *Ammophila arenaria*, 10 Dec. 1984, A. M. Buchanan 4763 (HOLOTYPE: HO 889020; ISOTYPE: NSW).

Differs from *Agrostis billardieri* var. *billardieri* in having a weak, straight, slender subterminal awn up to 4 mm long, or the awn absent. (Figs. 2b, 3)

DISTRIBUTION:

Tasmania; East coast and Furneaux Group, coastal sands.

SPECIMENS EXAMINED:

Tasmania—Whitemark, Flinders Island, Dec. 1979, D. I. Morris s.n. (HO 59170); Dolphin Sands, Nine Mile Beach, 29 Oct. 1981, A. M. Buchanan s.n. (HO 71577); Nine Mile Beach, near Point Bagot, 29 Dec. 1981, A. M. Buchanan 705 (HO); Dolphin Sands, Nine Mile Beach, 20 Feb. 1983, A. M. Buchanan 1186 (HO).

ETYMOLOGY:

Tenuiseta, slender-bristled, referring to the weak lemma awn

Agrostis lacunis D. Morris sp. nov.

Gramen perenne, erectum vel geniculatum-ascendens, glabrum, saepe ad nodos inferiores radicans et ramificans, 20–40 cm altum, in aqua ad margines lacunarum lacuumque in regionibus altioribus crescens. *Vaginae foliorum* costatae, longiores quam internodi, tandem laxae; vaginae foliorum inferiorum chartaceae, vaginae foliorum superiorum virides vel purpurascentes; ligulae usque ad 6 mm longae, anguste triangulares; laminae complanatae, usque ad 20 cm longae, usque ad 2.5 mm latae, virides vel purpurascentes, ambobus faciebuis subtiliter costatis, superficie minute scaberula. *Culmi* teretes, laeves, infra paniculas minute scaberuli. *Panicula* usque ad 12 cm longa, ad 7 cm lata, pyramidalis, ramis ad nodos inferiores 2–4 natis, ad nodos superiores binatis, axe et ramis pedicellisque scabris, *Spiculae* (2.5–) 2.75–4.0 mm longae. *Glumae* subaequales, aliquando inferiore parum longiore, carinis faciebusque scabris, purpurascentibus, marginibus membranaceis. *Lemma* (1.5–) 2–2.5 mm longum, dense sericeum, apice 4–dentato, arista ad circum medium inserta, 1.5–3.25 mm longa, stricta, gracili vel geniculata columna usque ad 1.5 mm longa. *Callus* dense barbatus. *Palea* parum brevior quam lemma, tenuiter membranacea. *Seta* rhachillae c. 0.5 mm longa, pilifera, pilis saepe paene aequans lemma. *Antherae* 0.6–0.8 mm longae.

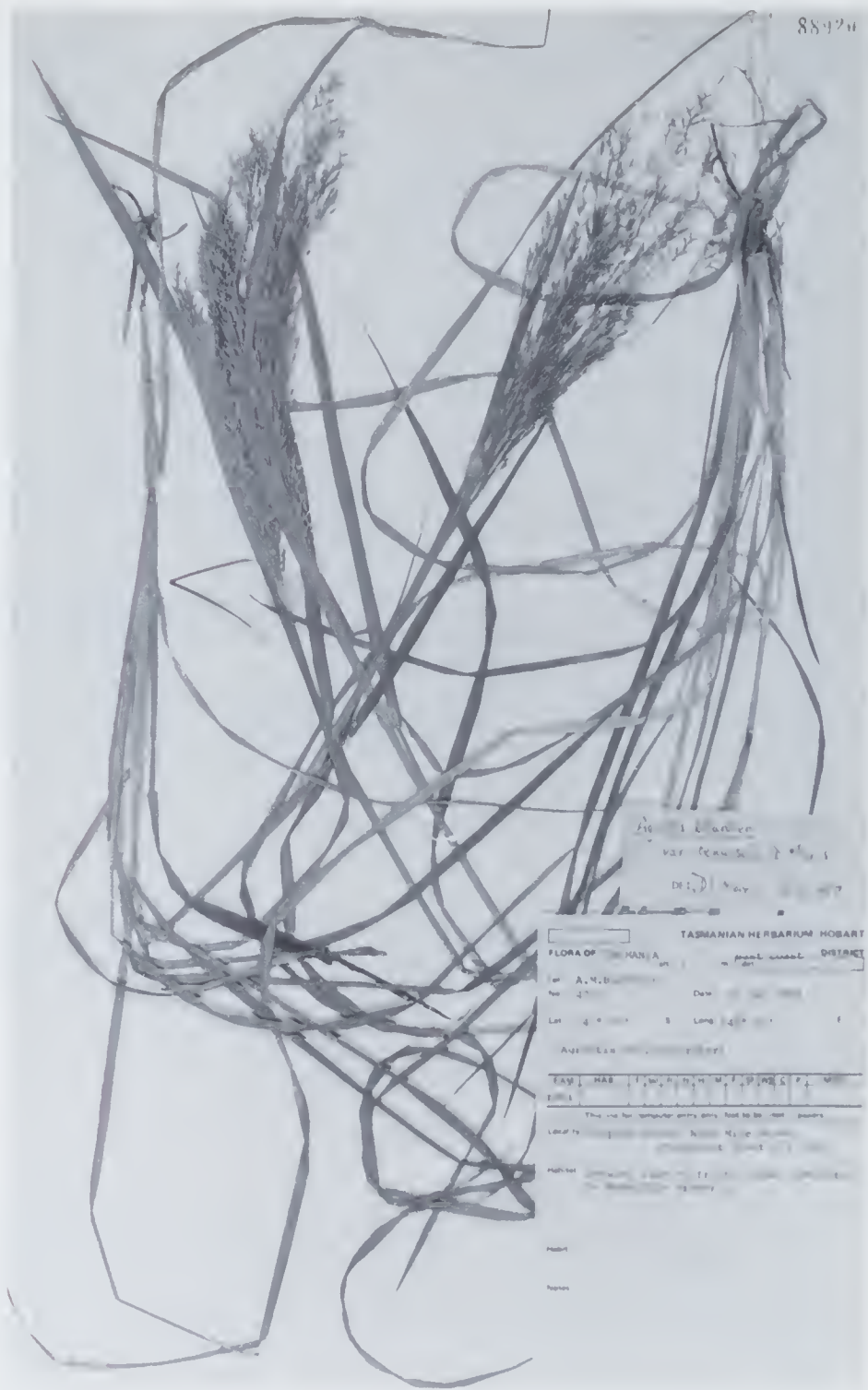


Fig. 3. Holotype of *Agrostis billardieri* var. *tenuiseta*.

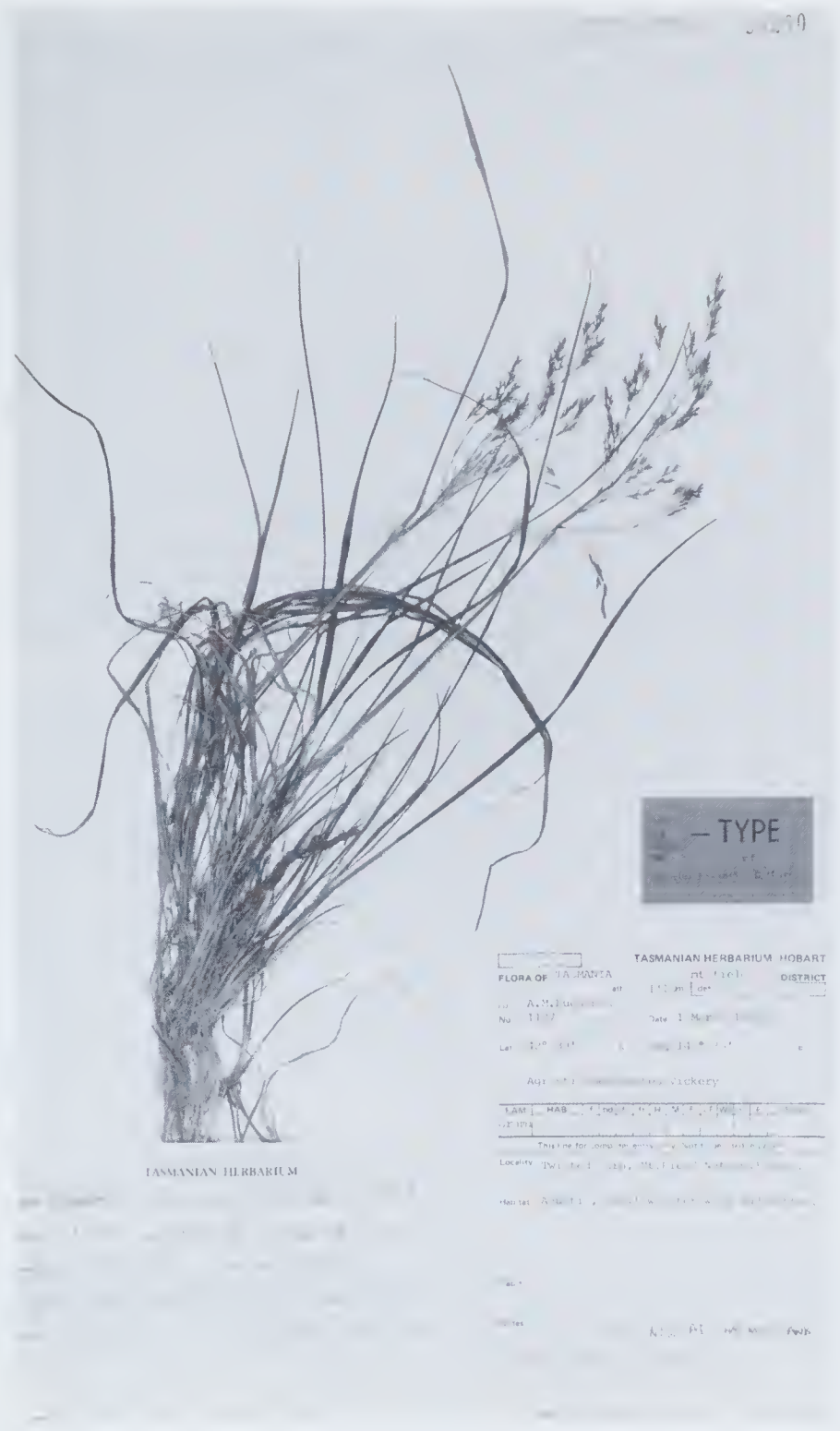


Fig. 4. Holotype of *Agrostis lacunis*.

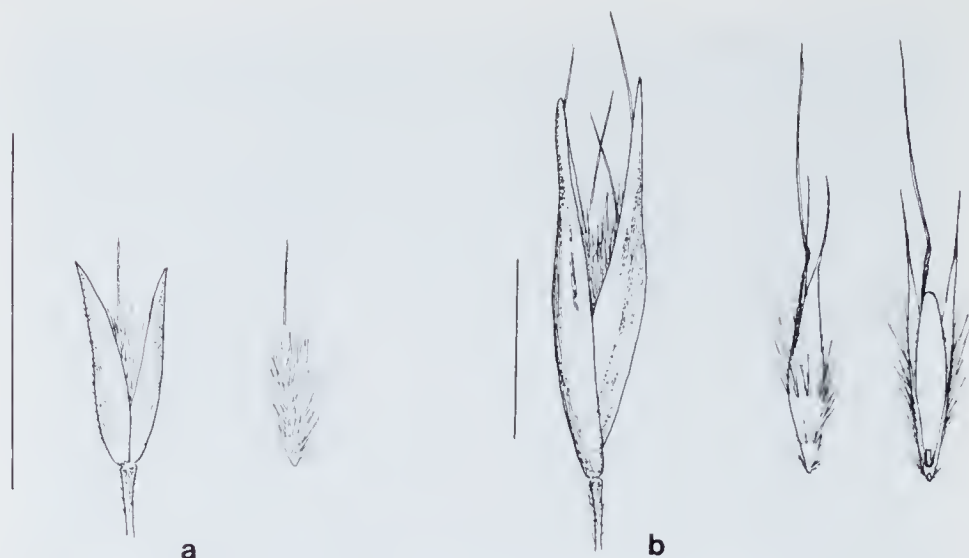


Fig. 5. a—Spikelet of *Agrostis lacunis*. b—Spikelet of *Danthonia diemenica*. Scale lines = 5 mm.

TYPUS: Tasmania, Twisted Tarn, Mt Field National Park, 1110 m; Aquatic, shallow water with mud bottom; 1 Mar. 1983, A. M. Buchanan 1187 (HOLOTYPE: HO 93290; ISOTYPE: AD, MEL, NSW, CANB, CHR).

Erect or geniculate—ascending, glabrous perennial often rooting and branching from the lower nodes, 20–40 cm high, growing in water at the edge of tarns and lakes in highland areas. *Leaf-sheaths* ribbed, longer than the internodes, becoming loose, lower sheaths chartaceous, upper green or purplish; ligules up to 6 mm long, narrow-triangular; blades flat, up to 20 cm long by up to 2.5 mm wide, green or purplish, both surfaces finely ribbed, upper surface minutely scaberulous. *Culms* terete, smooth, minutely scaberulous below the panicle. *Panicle* up to 12 cm long by up to 7 cm wide, pyramidal, the branches 2–4 nate at the lowest node, binate at upper nodes, axis, branches and pedicels scabrous. *Spikelets* (2.5–) 2.75–4.0 mm long. *Glumes* subequal, sometimes the lower slightly longer, keels and lateral faces scabrous, purplish, margins membranous. *Lemma* (1.5–) 2–2.5 mm long, densely silky-hairy, apex 4-toothed, awn inserted at about the mid-point, 1.5–3.25 mm long, the smaller awns straight, slender, larger awns geniculate with a column up to 1.5 mm long; callus densely bearded. *Palea* a little shorter than the lemma, thinly membranous. *Rhachilla* bristle c. 0.5 mm long, hairy, the hairs often almost equalling the lemma. *Anthers* 0.6–0.8 mm long. (Figs. 4, 5a)

DISTRIBUTION:

Tasmania; Central Highlands and Mount Field, 850–1250 m altitude.

SPECIMENS EXAMINED:

Tasmania—Artists Pool, Cradle Mountain 30 Jan. 1982, A. M. Buchanan 856 (HO); Artists Pool, Cradle Mountain, 3 Jan. 1983, A. M. Buchanan 1073 (HO); Lake Rosa, February Plains, 23 Jun. 1983, A. Moscal 1523 (HO); Twisted Tarn, Tarn Shelf, 1 Mar. 1983, A. M. Buchanan 1194 (HO, BAA); 2 km S of Devils Den, 2 Mar. 1984, A. Moscal 6697 (HO, AD); Gun Lagoon, 13 Apr. 1986, P. Collier 1321 (HO); Lake Ewart, 7 Feb. 1987, A. M. Buchanan 10046 (HO).

ETYMOLOGY:

Lacunis, of pools, relating to the habitat.

The spikelets of this species resemble those of *A. meionectes* but the plant

differs from that species in being apparently perennial, in its purely aquatic habit, generally larger size with much longer leaves, which are always flat, culms which are up to 8-noded, branching and rooting from the lower nodes and occasionally (*Buchanan 10046*) producing fascicles of aerial shoots from the upper nodes. Panicle branches are less rigidly divaricate than those of *A. meionectes* and the lemma is more densely hairy.

DANTHONIA LAM. *et* DC.

Danthonia diemenica D. Morris *sp. nov.*

Gramen perenne caespitosum vel breviter rhizomatosum, usque ad 35 cm altum. *Vaginae* manifeste costatae, marginibus hyalinis, vaginae inferae pallidae, plus minusque nitidae, glabrae vel interdum pilosae; cilia ligularum c. 0.5 mm longa, pilis longioribus ad margines; laminae usque ad 25 cm longae, plerumque tenues involutaeque, raro planae et usque ad 3 mm latae, glabrae vel interdum pilosae apice conduplicato. *Culmi* tenues, 4–5-nodati. *Panicula* usque ad 5 cm longa, lanceolata vel ovata, usque ad 15 spiculas ferens. Spiculae (10–) 12–15 (–18) mm longae, 4–6 flores ferentes, apicibus aristarum exsertis. *Glumae* lanceolatae, acutae, subaequales, purpurascens, 3–5-nervatae. *Lemmatis* infimi corpus 3.0–4.5 mm longum, nitidum, 9 nervatum, leniter ad callum decrescens; segmentum rhachillae c. 0.5 mm longum; pili calli 1–2 mm longi; pili seriei inferae ad 3 mm longi, interdum sparsi vel interrupti, series superior superpositi; pili seriei superae ad 4 mm longi, 1–2 mm sub sinum inserti, portionem planam loborum lateralium plus minusque longitudine aequantes, lobi laterales 5–6 mm longi, setas 2–2.5 mm longas includentes; arista ad 11 mm longa, columna 3–4 mm longa laxa torta, castanea, seta plerumque semel bisve torta. *Palea* elliptica, 1.5–2 mm longior quam sinus, dimidio supero membranaceo hebeti, dimidio infero nitido, carinis marginibusque dense ciliolatis, plerumque caespitibus pilorum inter carinas marginesque infra medium. *Antherae* c. 1.25 mm longae, citrinae. *Caryopsis* obovata 1.75–2 mm longa.

HOLOTYPE: Tasmania, Ouse River—Wild Dog Plains, 1160 m; Streambanks—sandy alluvium till. Erosion sites; 7 Jan. 1983, *A. Moscal 1292* (HO 65782).

Tufted or shortly rhizomatous perennial up to 35 cm high, the culms usually greatly exceeding the tuft of basal leaves. *Leaf-sheaths* prominently ribbed, margins hyaline, lower sheaths pale, \pm shining, glabrous or occasionally pilose; ligule a ciliate rim, the cilia c. 0.5 mm long with a sparse or dense tuft of longer hairs up to 2.5 mm long at each margin; blades up to 25 cm long, usually fine and inrolled but rarely flat *in vivo* and up to 3 mm wide, glabrous or occasionally pilose, the apex folded. *Culms* slender, smooth, 4–5-noded. *Panicle* up to 5 cm long, lanceolate or ovate; axis, branches and pedicels scabrous or hispid, bearing up to 15 spikelets. *Spikelets* (10–) 12–15 (–18) mm long, 4–6-flowered, tips of the awns exserted. *Glumes* lanceolate, acute, subequal, purplish, margins pale or purplish, 3–5-nerved. *Body* of the lowest lemma 3.0–4.5 mm long, shining, 9-nerved, fairly broad, tapering gradually to the callus; rhachilla segment c. 0.5 mm long, callus hairs 1–2 mm long, overlapping the lower row of hairs, hairs of lower row sometimes sparse or interrupted, up to 3 mm long, overlapping the upper row, hairs of upper row up to 4 mm long, \pm equalling the flattened portion of the lateral lobes, inserted 1–2 mm below the sinus; lateral lobes 5–6 mm long including the 2–2.5 mm long setae; awn up to 11 mm long, the column 3–4 mm long, loosely twisted, chestnut brown, bristle usually once or twice twisted. *Palea* elliptical, exceeding the sinus by 1.5–2 mm, apex truncate or shallowly bifid, upper half membranous, dull, lower half firm, shining, keels densely and minutely ciliate, usually with sparse tufts of long hairs between keels and margins below the mid-point. *Anthers* c. 1.25 mm long, pale yellow. *Caryopsis* obovate, 1.75–2 mm long. (Figs. 5b, 6)

DISTRIBUTION:

Tasmania; predominantly in the Central Highlands but also North East, Ben Lomond, East Coast, Mt Wellington, South West, 480–1250 m altitude.



Fig. 6. Holotype of *Danthonia diemenica*.

SELECTED SPECIMENS EXAMINED (Total 60):

Tasmania—Saddle between Eldon Bluff and Dome Hill, 6 Feb. 1987, A. M. Buchanan 10043 (HO); Back Peak, 17 Jan. 1988, P. Collier 3094e (HO); Mt Wellington, 4 Jan. 1972, J. H. Hemsley 6707 (HO, K); Divide between Julian Lakes and Pillans Lake, 8 Jan. 1983, A. Moscal 1332 (HO, MEL); February Plains, 28 Jan. 1983, A. Moscal 1542 (HO); Wild Dog Tier, 9 Mar. 1984, A. Moscal 6798a (HO); Between Prince Albert's Throne and Lake Ila, 17 Mar. 1984, A. Moscal 7098 (HO); Dunning Rivulet, 28 Feb. 1986, A. Moscal 12525 (HO); Tower Hill, East Tower, 13 Feb. 1980, M. G. Noble 29051 (HO); Western Mountains, Dec. 1908, L. Rodway s.n. (HO 27935); South slope of the southern hill of Sabrina Hills, 8 km SE of Bothwell, 15 Dec. 1986, D. Ziegler 47 (HO).

ETYMOLOGY:

Diemenica, in reference to Van Diemens Land, the early name for Tasmania.

D. diemenica has in the past been confused with *D. tenuior* and *D. caespitosa*, differing from the former in having a shorter callus, longer rachilla segment and a palea exceeding the lemma sinus by 1.5–2 mm; differing from the latter in the shorter callus, shorter lateral lobes and in having fewer florets per spikelet. Differences between the species are summarised in the following table:

	<i>D. tenuior</i>	<i>D. caespitosa</i>	<i>D. diemenica</i>
Callus	1–1.5 mm	0.75–1.5 mm	0.5 mm
Rachilla segment	0	0	0.5 mm
Lemma lobes	7–10 mm	8–13 mm	5–6 mm
Florets per spikelet	4–6	7–9	4–6
Amount by which the palea exceeds the lemma sinus	up to 1 mm	0.75–1.5 mm	1.5–2 mm

Danthonia nitens D. Morris *sp. nov.*

Gramen perenne, caespitosum, usque ad 25 cm altum. *Vaginae* glabrae vel raro sparsim pilosae, costatae; cilia ligularum 0.5 mm longa caespitibus pilorum ad 2 mm longis ad margines; laminae foliorum inferiorum usque ad 9 cm longae, involutae vel planae, usque ad 1.5 mm latae, glabrae vel interdum pilosae. *Culmi* plerumque 3-nodati, laeves, subtiliter costati infra nodos, scabri-pilosi infra paniculam. *Inflorescentia* racemosa vel panicula deminuta 0.9–3.5 cm longa 2–4 (–8) spiculas ferens; spiculae ad nodos omnes solitariae vel, in plantis majoribus, nodi inferi ramum solitarium spiculis duabus efferentes; axis et rami et pedicelli pilosi, pilis densioribus infra glumas. *Spiculae* 4–6 flores ferentes, flore terminali saepe sterili, apicibus aristarum lemmatum breviter exsertis. *Glumae* subaequales, 6.5–7.5 mm longae × 2.5 mm latae, lanceolatae apicibus obtusis; gluma inferior 5–7-nervata, gluma superior 5(–7) nervata. *Lemma* ellipticum, corpore 2.25–3.25 mm longo, nitens, 7-nervatum, glabrum, praeter caespitem pilorum aliquantum sparsum c. 1 mm longum ad ambo margines ad medium et caespitem minorem ad ambo margines supra callum; lobi laterales angusti ubique 1.25–2 mm longi, abrupte ad apicem acutum vel leniter ad setam brevem decrescentes arista 3–4 mm longa, columna c. 1 mm longa, mellea; callus pilis densis c. 1 mm longis. *Palea* lanceolata-elliptica vel oblanceolata-elliptica, sinum lemmatis excedens, brevior quam portio plana loborum lateralium, nitens, apice truncato, breve bifido, carinis ciliatis in triente superno. *Antherae* 0.3–0.6 mm longae. *Caryopsis* c. 1.5 mm longa.

HOLOTYPE: Tasmania, Dublin Forest Block, 21 Jan. 1979, H. Fletcher s.n. (HO 30982).

Tufted perennial up to 25 cm high. *Leaf-sheaths* glabrous or rarely sparsely pilose, ribbed, lower sheaths pale, shining or dull; ligule of cilia up to 0.5 mm long with tufts of longer hairs up to 2 mm long at each margin; blades of basal leaves up to 9 cm long, involute or flat and up to 1.5 mm wide; glabrous or occasionally pilose. *Culm* usually 3-noded, smooth, finely ribbed below the nodes, scabrous-pilose below the panicle. *Inflorescence* racemose or a reduced panicle 0.9–3.5 cm long bearing 2–4 (–8) spikelets; spikelets solitary at each node or in larger plants the lower nodes producing a single branch bearing two spikelets; axis, branches and pedicels pilose, the hairs denser below the glumes. *Spikelets* 4–6 flowered, the terminal floret often sterile, tips of lemma awns shortly exserted. *Glumes* subequal, 6.5–7.5 mm long × 2.5 mm broad, lanceolate, apex obtuse, lower glume 5–7 nerved, upper 5 (–7) nerved. *Lemma* elliptical, body 2.25–3.25 mm long, shining, 7-nerved, glabrous



Fig. 7. Holotype of *Danthonia nitens*.

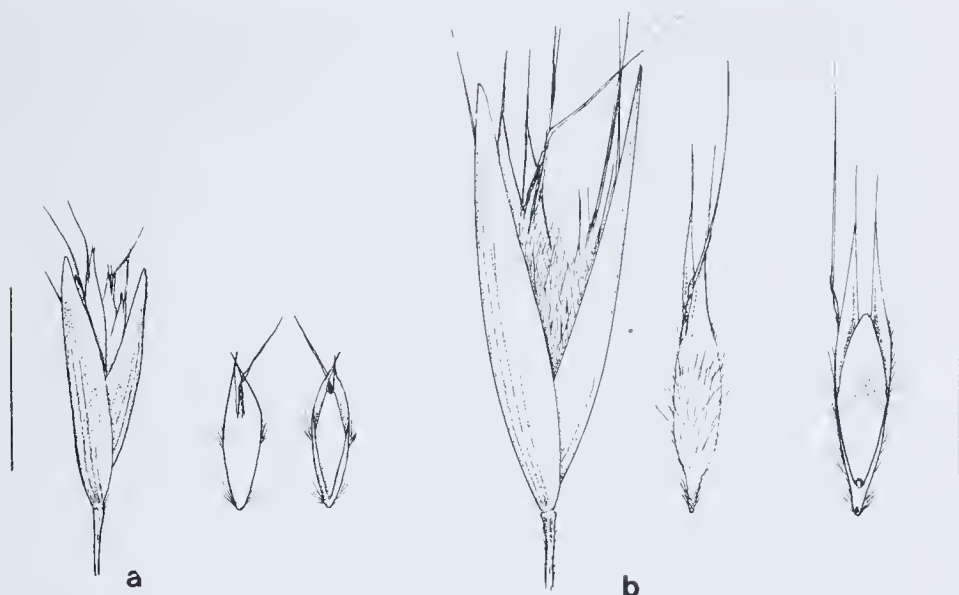


Fig. 8. a—Spikelet of *Danthonia nitens*. b—Spikelet of *Danthonia popinensis*. Scale lines = 5 mm.

except for a rather sparse tuft of hairs c. 1 mm long on each margin at about the mid-point and a smaller tuft on each margin above the callus; lateral lobes narrow, 1.25–2 mm long overall, tapering abruptly to an acute apex or more gradually to a short seta; awn 3–4 mm long, the column c. 1 mm long, honey brown; callus hairs dense, c. 1 mm long. *Palea* lanceolate-elliptic to oblanceolate-elliptic, exceeding the sinus, shorter than the broad portion of the lateral lobes, shining, apex truncate, shortly bifid, keels ciliate in the upper third. *Anthers* 0.3–0.6 mm long. *Caryopsis* c. 1.5 mm long, obovoid. (Figs. 7, 8a)

DISTRIBUTION:

Tasmania; Central Highlands, grass-heathlands and open woodlands, mostly between 1000 and 1200 m altitude.

SPECIMENS EXAMINED:

Tasmania—Franklin River, Lyell Highway, 23 Jan. 1949, S. T. Blake 18406 (HO, BRI); Near Lake St Clair, 5 Jan. 1977, R. Mason s.n. (HO 35755, CHR 308847); Billop Bluff, N of Arthurs Lake, 18 Feb. 1981, A. Moscal s.n. (HO 40221); Rushcroft Creek, 21 Feb. 1984, A. Moscal 6348 (HO); Smiths Tops, 21 Feb. 1984, A. Moscal 6367 (HO); 1.5 km W of Norths Hill, 27 Feb. 1984, A. Moscal 6530 (HO); Ouse River, Little Split Rock, 28 Feb. 1984, A. Moscal 6576 (HO).

ETYMOLOGY:

Nitens, shining, in reference to the shining lemma.

Danthonia nitens appears most closely related to *D. nivicola* from which it differs in having less stiffly erect culms, the uppermost node usually exerted above the basal tuft of leaves, pilose panicle branches, prominently nerved glumes and the shining elliptical lemma with hair-tufts only at the margins.

Danthonia popinensis D. Morris sp. nov.

Gramen perenne caespitosum, glabrum, usque ad 45 cm altum. *Vaginae* foliorum inferorum pallidae, \pm nitidae, costatae, internodiis longiores vel breviores; *vaginae* foliorum superiorum costatae internodiis breviores; laminae foliorum inferorum planae, minimum basi, usque ad 15 cm longae \times usque ad 2 mm latae, superficie adaxiali subtiliter costata, costis minute scaberulis, marginibus carinisque in dimidio superiore scaberulis; laminae foliorum superiorum tenuiores, involutae. *Culmi*

laeves, subtiliter costati, nodis purpurei. *Panicula* usque ad 8 cm longa, lanceolata vel linearis, viridis, ramis pedicellisque scabris vel hispidis. *Spiculae* 13–14 mm longae, aristas excludentes quas per 3–4 mm exsertuntur, 5–6 floratae. *Glumae* subaequales, lanceolatae-acutae, virides, marginibus latis hyalinis, gluma infera c. 14 mm longa, 7-nervata, gluma supera c. 13 mm longa, 5-nervata. *Corpus lemmatis* infimi 7-nervatum, 4–4.5 mm longum, callo stipitato 1–1.5 mm longo dense barbato incluso, serie infera pilorum ad seriem superom attigenti; serie supera pilorum c. 4 mm longa, infra sinum c. 1 mm inserta, area inter series pilis dispersis c. 2 mm longis; caespitibus densis pilorum ad ambo margines; lobi laterali c. 7 mm long, portione plana longitudine setam \pm aequans; arista c. 12 mm longa, columna c. 2.5 mm longa, arcte torta, brunnea. *Palea* c. 5 mm longa, oblanceolata, apice bifido, sinum lemmatis 2.5 mm excedens, carinis ciliatis, serie pilorum usque ad 2.5 mm longos secus ambo latera inter carinam marginemque in inferis 2/3. *Antherae* c. 1 mm longae. *Caryopsis* c. 2 mm longa obovata.

TYPUS: Tasmania 0.5 km N of Kempton, opposite 'Mood Food', Roadside, 25 Apr. 1985, *D. I. Morris* 8556 (HOLOTYPE: HO 92651; ISOTYPI HO,AD,NSW).

Tufted glabrous perennial up to 45 cm high. *Lower* leaf-sheaths pale, \pm shining, ribbed, shorter or longer than the internodes, upper leaf sheaths ribbed, shorter than the internodes; blades of lower leaves flat, at least at the base, up to 15 cm long by up to 2 mm wide, abaxial surface prominently ribbed, adaxial surface finely ribbed, the ribs minutely scaberulous, margins and keel scabrous in the upper half, upper leaves finer, inrolled. *Culms* smooth, finely ribbed; nodes purple. *Panicle* up to 8 cm long, lanceolate to linear, pale green, branches and pedicels scabrous to hispid. *Spikelets* 13–14 mm long excluding the awns which are exserted for 3–4 mm, 5–6 flowered. *Glumes* subequal, lanceolate-acute, green with wide hyaline margins, lower glume c. 14 mm long, 7-nerved, upper c. 13 mm long, 5-nerved. *Body of lowest lemma* 7-nerved, 4–4.5 mm long including the stipe-like, 1–1.5 mm long, densely bearded callus; lower row of hairs reaching to the upper row, upper row of hairs c. 4 mm long, inserted c. 1 mm below the sinus, area between the two rows with scattered hairs c. 2 mm long, dense tufts at each margin at the level of the upper and lower rows of hairs; lateral lobes c. 7 mm long, the flattened portion and the setae \pm equal; awn c. 12 mm long, column c. 2.5 mm long, tightly twisted, brown. *Palea* c. 5 mm long, oblanceolate, apex bifid, exceeding the sinus of the lemma by c. 2.5 mm; keels ciliate throughout; a row of hairs up to 2.5 mm long down each side between keel and margin in the lower two thirds. *Anthers* c. 1 mm long. *Caryopsis* c. 2 mm long, obovate. (Figs. 8b, 9)

DISTRIBUTION:

Tasmania; Midlands.

SPECIMENS EXAMINED:

Tasmania—0.5 km N of Kempton on Midlands Highway, 23 Mar. 1985, *D. I. Morris* 8541 (HO); 1/2 km N of Kempton, opposite 'Mood Food', 16 Jan. 1987, *D. I. Morris* 86162 (HO,MEL,NSW).

ETYMOLOGY:

From *popina*, an eating place. The grass was first found in March 1985 when the author, heading north from Hobart on a collecting trip with Dr. Winifred Curtis, stopped for petrol at a wayside garage and cafe trading under the name 'Mood Food'. For some months the specimens were stored as '*D. moodfoodensis*', a name perhaps too frivolous for publication and the epithet *popinensis* was selected as an acceptable alternative.

Danthonia popinensis resembles *D. monticola* in having scattered hairs between the upper and lower rows of hairs on the lemma but differs in having longer glumes, the lower of which is 7-nerved, the upper 5-nerved, body of the lemma 4–4.5 mm long and the upper row of hairs up to 4 mm long. It differs from *D. linkii* var. *fulva* in being generally a smaller plant and in having the hairs on the back of the lemma scattered between a lower row of hair-tufts c. 2 mm long and an upper row c. 4 mm long whereas in *D. linkii* var. *fulva* the lower row of hair-tufts is absent and the hairs on the back are evenly scattered, grading into the upper row of hairs which are c. 5 mm long. The inter-carinal area of the palea is glabrous in *D. popinensis* but is hairy in *D. linkii* var. *fulva*.

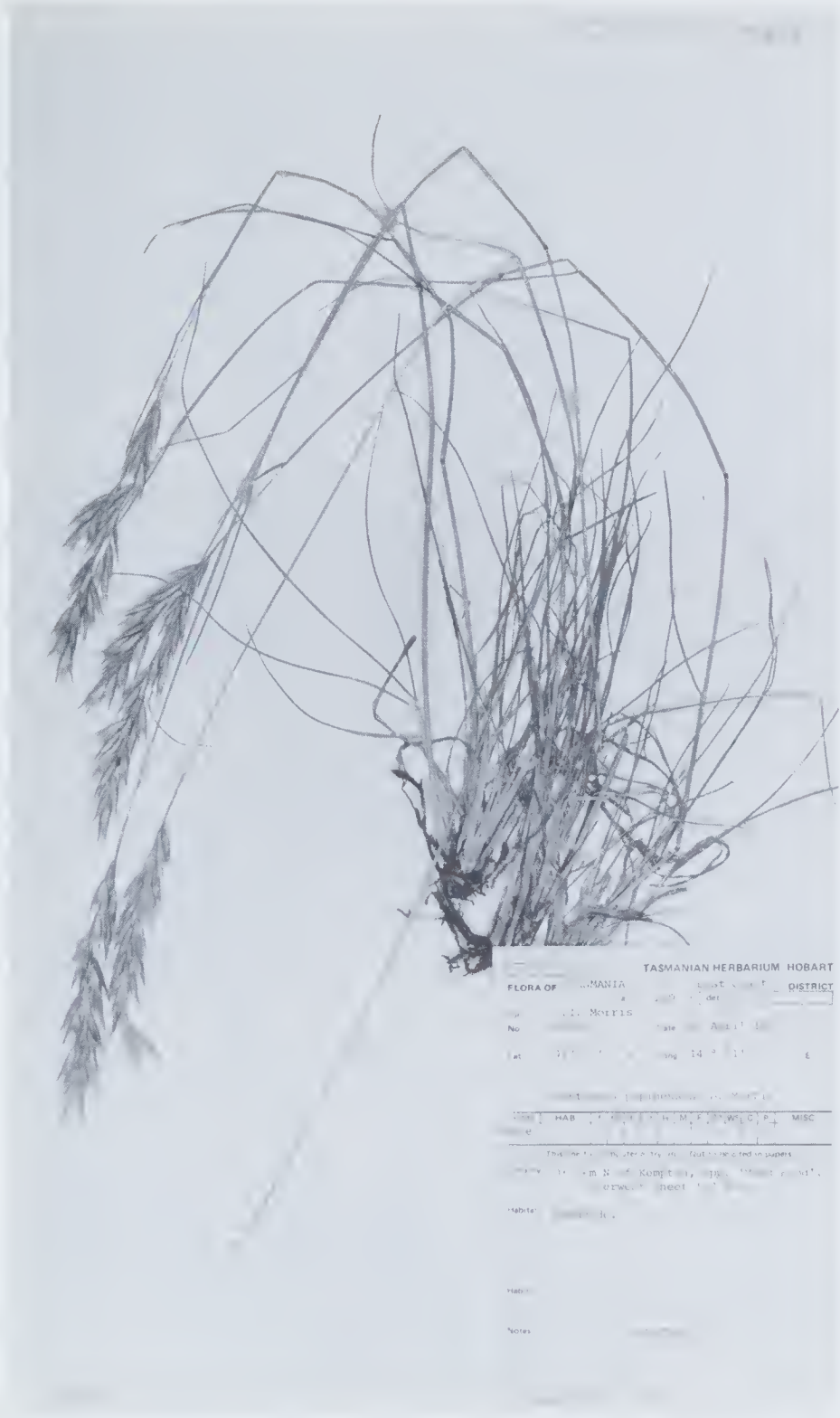


Fig. 9. Holotype of *Danthonia popinensis*.

Danthonia remota D. Morris *sp. nov.*

Gramen perenne laxae caespitosum usque ad 20 cm altum. *Vaginae* foliorum laeves, manifeste costatae, vaginae foliorum inferiorum pallidae \pm nitidae; ligulae ciliatae, usque ad 1 mm longae; laminae usque ad 4 cm longae, arcte conduplicatae, filiformes, laeves, apice acuto. *Culmi* tenues, erecti, laeves. *Panicula* ovata usque ad 3 cm longa, 2–7 spiculas ferens, axe et ramis et pedicellis hispidis vel pilosis. *Spiculae* 9–12 mm longae, 4–5-floratae, apicibus aristarum exsertis. *Glumae* longitudine aequales vel superae quam inferae parum breviores, lanceolatae, obtusae; gluma infera 9–13-nervata, gluma supera 7-nervata. *Lemmata* oblanceolata, corpore lemmatis infimi c. 3 mm longo, callo usque ad 0.75 mm longo, barbato, pilis ad seriem inferam pilorum lemmatis attigentibus; serie infera pilorum ad 2–4 caespites sparsos reductis, caespitibus longioribus ad margines; series supera pilorum c. 1.5 mm longa, sparsissima vel ad 2 caespites reducta, caespitibus longioribus et densioribus ad margines c. 0.75 mm infra sinum inserta; lemmate aliquando purpureo-fasciato infra sinum; lobi laterales c. 6 mm longi, portionibus planis 2.5 mm longis, marginibus latis hyalinis, gradatim ad setas angustatis vel ad juncturam minute lobatis; arista 7.5–9 mm longa, columna 2.5 mm longa, brunnea, torta. *Palea* oblanceolata, 3.5–4 mm longa, marginibus superne ciliolatis, area dorsali \pm nitida, apice acuto vel truncato, breviter bifido vel irregulariter et oblique trilobato. *Antherae* c. 0.75 mm longae. *Caryopsis* c. 1.5 mm longa.

HOLOTYPE: Tasmania, Summit area of Hibbs Pyramid, 4 Feb. 1984, A. M. Buchanan (HO 91392).

Loosely tufted glabrous *perennial* up to 20 cm high from a tuft of basal leaves. *Leaf-sheaths* smooth, prominently ribbed, lower sheaths pale, \pm shining; ligule ciliate, up to 1 mm long, blades up to 4 cm long, tightly infolded, smooth, filiform, apex sharply pointed. *Culm* slender, erect, smooth. *Panicle* ovate, up to 3 cm long, bearing 2–7 spikelets, axis, branches and pedicels hispid to pilose. *Spikelets* 9–12 mm long, 4–5 flowered, tips of awns exserted. *Glumes* equal or subequal with the lower slightly longer, lanceolate, obtuse, lower glume 9–13-nerved, upper glume 7-nerved. *Body of lowest lemma* c. 3 mm long, oblanceolate, callus up to 0.75 mm long, bearded, the hairs reaching to the lower row of callus hairs; lower row reduced to 2–4 sparse tufts with longer tufts at the margin; upper row of very sparse tufts or reduced to 2 sparse tufts with longer tufts at the margin; upper row of very sparse tufts or reduced to 2 sparse dorsal tufts with longer and denser tufts at the margin, inserted c. 0.75 mm below the sinus, the hairs c. 1.5 mm long; sometimes a band of purple coloration across the body below the sinus, paling with age; lateral lobes c. 6 mm long, the flattened portion c. 2.5 mm long, with wide hyaline margins, tapering gradually to the setae or minutely lobed at the junction; awn 7.5–9 mm long, column 2.5 mm long, brown, twisted. *Palea* 3.5–4 mm long, oblanceolate, margins ciliolate above, dorsal area \pm shining, apex acute or truncate, shortly bilobed or irregularly and obliquely trilobed. *Anthers* c. 0.75 mm long. *Caryopsis* c. 1.5 mm long. (Figs. 10, 11a)

DISTRIBUTION:

Tasmania; known only from the type collection from the summit of Hibbs Pyramid, a small dolorite island north of Point Hibbs on the West Coast, at an altitude of 70 m and from a second collection from the same site, Dec. 1988, N. Brothers *s.n.* (HO 113101, MEL, NSW).

ETYMOLOGY:

Remota, distant, far off, relating to the isolated locality of Hibbs Pyramid.

The species appears most closely related to *D. pilosa* from which it differs in being completely glabrous, having spikelets 4–5 flowered, lower glume 9–13-nerved and an awn 7.5–9 mm long.

DEYEUXIA CLARION EX P. BEAUV.

Deyeuxia apsleyensis D. Morris *sp. nov.*

Gramen perenne laxae caespitosum usque ad 90 cm altum. *Vaginae* foliorum internodiis breviores, virides vel purpurascens, vaginae foliorum inferiorum pilosae, foliorum superiorum \pm glabrae, \pm retrorse scabrae; ligulae 1 (–2) mm longae, obtusae, dorsalis hirsutae, ciliolatae; laminae foliorum

91592



Fig. 10. Holotype of *Danthonia remota*.



Fig. 11. a—Spikelet of *Danthonia remota*. b—Spikelet of *Deyeuxia apleyensis*. Scale lines = 5 mm.

basalium et foliorum surculorum vegetativorum usque ad 35 cm longae \times usque ad 1.5 mm latae ubi complanatae, arcte conduplicatae vel involutae, pilosae; laminae foliorum culmorum gradatim minores, foliorum summorum saepe minus quam 1 mm longae, glabrae. Culmi tenues, laeves, sub nodis scaberuli vel aliquando dense pilosi, internodis saepe purpurascensibus, nodis purpurascensibus, glabris. Panicula laxa vel laxe contracta, usque ad 14 cm longa, ramis usque ad 4.5 cm longis; rhachis et rami et pedicelli scabri, viridi vel purpurascens. Spiculae 5.5–6.5 mm longae, lemmate glumas aequante vel excedenti. Glumae lanceolatae, acutae vel apiculatae, aequales vel subaequales, laeves vel parce scaberulae, carinis dense scaberulis; gluma infera 4.5–5 mm longa, gluma supera 5–6.5 mm longa. Callus barbatus pilis usque ad 1.5 mm longis. Lemma 5–6.5 mm longum, lanceolatum, cartilagineum, scaberulum, 5-nervatum, apice breviter bidentato, arista 7.5–8 mm longa in triente basali lemmatis inserta, geniculata, columna torta lemma \pm aequanti. Palea lemma aequans vel parum excedens, carinis ciliolatis. Segmentum rhachillae c. 1.5 mm longum, pilosum, pilis usque ad 1.5 mm longis. Antherae 2 mm longae. Caryopsis c. 3 mm longa.

TYPUS: Tasmania, Apsley River area, north of Apsley Gorge, 3 Feb. 1988, F. Duncan, s.n. (HOLOTYPE HO 111147; ISOTYPE NSW).

Loosely tufted erect *perennial* up to 90 cm high. *Leaf-sheaths* shorter than the internodes, green or purplish, lower sheaths pilose, upper sheaths \pm glabrous, \pm retrorsely scaberulous; ligules 1 (–2) mm long, rounded, hairy on the back, ciliate; blades of basal leaves and those of vegetative shoots up to 35 cm long \times up to 1.5 mm wide when flattened; tightly folded or inrolled, pilose; blades of culm leaves progressively smaller, the uppermost often less than 1 cm long, glabrous. Culms slender, smooth, scaberulous or sometimes densely pilose below the nodes, lower internodes often purplish, nodes purple, glabrous. *Inflorescence* an open or loosely contracted panicle up to 14 cm long, branches up to 4.5 cm long, rhachis, branches and pedicels scabrous, green or purplish. *Spikelets* 5.5–6.75 mm long, the lemma equalling or exceeding the glumes. *Glumes* lanceolate, acute to apiculate, unequal to subequal, smooth or sparingly scaberulous, keels densely scaberulous, lower glume 4.5–5 mm long, upper 5–6.5 mm long. *Callus* bearded, the hairs up to 1.5 mm long. *Lemma* 5–6.5 mm long, lanceolate in outline, firm, scaberulous, 5-nerved, apex shortly 2-toothed; awn 7.5–8 mm long inserted in the basal 1/3 of the lemma, geniculate, column twisted, \pm equalling the lemma. *Palea* equalling or slightly exceeding the lemma, keels ciliate. *Rhachilla* segment c. 1.5 mm long, hairy, the hairs up to 1.5 mm long. *Anthers* 2 mm long. *Caryopsis* c. 3 mm long. (Figs. 11b, 12)

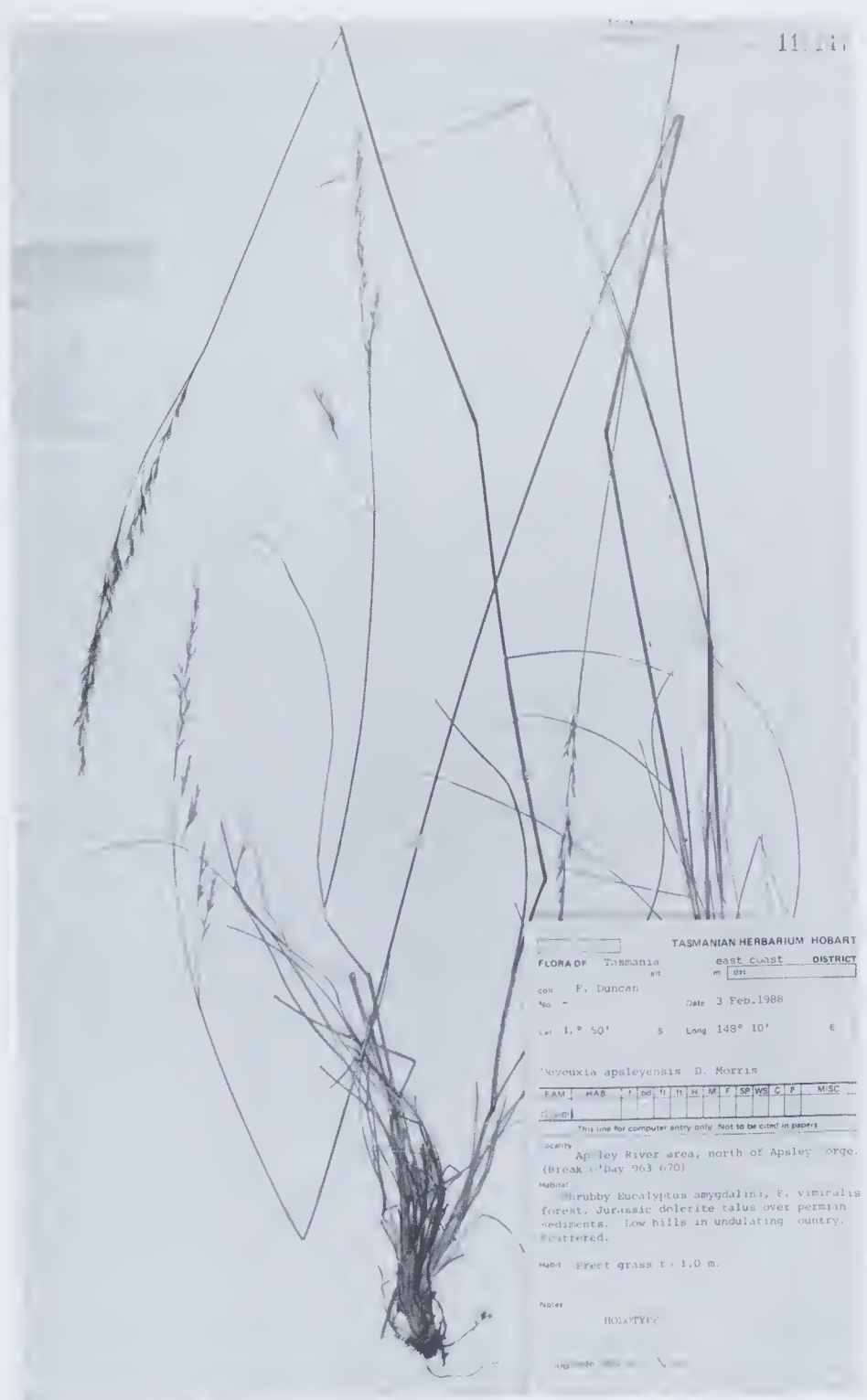


Fig. 12. Holotype of *Deyeuxia apseyensis*.

DISTRIBUTION:

Tasmania; East coast, valley of the Apsley River in *Eucalyptus amygdalina*—*E. viminalis* forest in undulating low hills.

SPECIMENS EXAMINED:

Tasmania—Ridge 3 km N of Apsley River Gorge, 9 Jan. 1988, *F. Duncan s.n.* (HO 111250); Apsley river catchment, W of Possum Creek, 16 Mar. 1988, *F. Duncan s.n.* (HO 111249).

D. apseyensis resembles *D. monticola* in having the lemma awn inserted in the basal 1/3 and a hairy rhachilla segment but has a larger spikelet, an open or loosely contracted panicle and pilose leaves.

Deyeuxia innominata* D. Morris *sp. nov.

Gramen perenne, laxum vel aliquantum dense caespitosum, plerumque usque ad 25 cm altum autem in habitationibus salutarissimum ad 60 cm attingens. *Vaginae* foliorum non profunde costatae, marginibus membranaceis ad ligulam connexis; ligulae membranaceae, truncatae, 2.0–2.5 mm longae; laminae usque ad 8 (–15) cm longae, conduplicatae vel involutae, tenues et flexiles vel aliquantum rigidae, saepe arcuatae, laeves, glabrae vel interdum ad superficiem abaxialem setosae, costis ad superficiem adaxialem hispidulis vel glabris. *Culmi* tenues, plerumque quam folia basalia multi longiores, laeves vel interdum antrorse scaberuli infra paniculam. *Paniculae* 2–8 cm longae, laxae contractae, ramis pedicellisque scabris, ramis basalibus saepe nudis per 1 cm supra basin. *Spiculae* 2–3.5 mm longae, purpurascens vel subvirides. *Glumae* subaequales, gluma supera plerumque quam gluma inferior parum longior, acutae, carinis in dimidio supero scaberulis. *Lemma* (2.0–) 2.25–3.0 mm longum parum brevius vel parum longius quam glumae, 5-nervatum, nervis obscuris vel prominentibus, parum induratum, cum vel sine arista. *Arista* parvula, recta, subterminalis, plerumque lemmati non excedens autem aliquando ad 1 mm attingens. *Pili* calli densi, plerumque ad dimidium lemmatis attigentes vel aliquando parum longiores. *Palea* hyalina plerumque quam lemma c. 0.5 mm brevior, carinis viridibus, non ciliatis. *Segmentum* rhachillae c. 1 mm longum, plumosum, pilis ± palea aequantibus. *Antherae* 0.5–0.75 mm longae. *Caryopsis* elliptica, c. 1.5 mm longa.

TYPUS: Tasmania, Wurragurra Creek, 29 Jan. 1983, A. Moscal 1569, (HOLOTYPE: HO 62754; ISOTYPE NSW).

Erect loosely or occasionally somewhat densely tufted *perennial*, usually up to 25 cm high but in very favourable situations reaching 60 cm. *Leaf-sheaths* shallowly ribbed, margins membranous, merging with the ligule; ligule membranous, truncate 2–2.5 mm long; blades up to 8 (–15) cm long, folded or inrolled, slender and flexible, somewhat stiff, often arcuate, smooth, glabrous or sometimes setose on the abaxial surface, the ribs on the adaxial surface glabrous or hispidulous. *Culms* slender, usually exerted well beyond the basal leaves, smooth or sometimes antrorsely scaberulous below the panicle. Panicle 2–8 cm long, loosely contracted, narrowly elliptical to linear in outline, branches and pedicels scabrous, basal branches often bare at the base for 1 cm or more. *Spikelets* 2–3.5 mm long, purplish or pale green. *Glumes* subequal, the upper usually slightly the longer, acute, keels scaberulous in the upper half. *Lemma* slightly shorter than, to slightly longer than the glumes, 2.25–3.0 mm long, 5-nerved, the nerves obscure or prominent, slightly indurated, with or without a small straight subterminal awn usually not exceeding the lemma but occasionally up to 1 mm long; callus hairs dense, usually half as long as the lemma, occasionally more. *Palea* hyaline, usually about 0.5 mm shorter than the lemma, keels green, not ciliate. *Rhachilla* segment about 1 mm long, plumose, the hairs ± equalling the palea. *Anthers* 0.5–0.75 mm long. *Caryopsis* elliptical, c. 1.5 mm long. (Figs 13, 14)

DISTRIBUTION:

Tasmania; Central Highlands, Ben Lomond, Mt Field, Mt Wellington, South West, East Coast, West Coast, 550 m to 1300 m, alpine moorland, boulder fields, sedge-grasslands, heaths; Victoria; Nunniong Plateau, Cobberas Mountains, Baws Baws, The Bluff, Mt Buffalo, Bogong High Plains; New South Wales; subalpine areas in the Kosciuszko region, Kiandra, Southern Tablelands, Northern Tablelands; A.C.T. Mt Gingera, Mt Bimberi.



Fig. 14. Spikelet of *Deyeuxia innominata*. Scale = 5 mm.

SELECTED SPECIMENS EXAMINED (Total 36):

Tasmania—Wombat Moor, Mt Field National Park, 19 Jan. 1979, *D. I. Morris* (HO); Pool of Bethesda, 18 Jan. 1983, *A. Moscal 1418* (HO); Lake Skinner, 19 Mar. 1983, *A. Moscal 2076* (HO); Liffey Bluff, 29 Mar. 1983, *A. Moscal 2202* (HO); Mackenzies' Tier, 22 Feb. 1984, *A. Moscal 6444* (HO); Kermandie Plain, 11 May 1985, *A. Moscal 10890* (HO); Mt Wellington, 6 Mar. 1974, *D. & A. Ratkowsky s.n.* (HO 10437); Top of Mt Mawson, 5 Apr. 1964, *J. E. S. Townrow s.n.* (HO 107849); Path to Arve Falls, Hartz Moor, 20 Jan. 1967, *J. E. S. Townrow s.n.* (HO 107488).

Victoria—The Bluff, 22 Jan. 1981, *N. G. Walsh 953* (MEL).

ETYMOLOGY:

Innominata, unnamed. The species has been recognised but unnamed for many years.

The species has been referred to in the following publications:

Burbidge, N. T. & Gray, M., *Flora of the A.C.T.*, 47 (1970) as *D. sp.*

Thompson, J., *A Key to the Plants of the Subalpine and Alpine Zones of the Kosciusko Region: Telopea* 2(3), 240 (1981) as *D. sp.*

Jacobs, S. W. L. and Pickard, J., *Plants of New South Wales* 42 (1981) as *D. sp. aff. parviseta*.

Wheeler, D. J. B., Jacobs, S. W. L., & Norton, B. E., *Grasses of New South Wales*, 159 (1982) as *D. sp. aff. parviseta*.

Forbes, S. J. & Ross, J. H., *A Census of the vascular Plants of Victoria, Second Edition*, 22 (1988) as *D. sp.*

This species is closely related to *D. affinis* M. Gray from which it differs in

having glumes which are acute as compared to the acuminate or mucronate glumes of *D. affinis*, the lemma is less conspicuously acute, the callus hairs are usually not more than half as long as the lemma and the awn, although occasionally up to 1 mm long does not usually exceed the lemma and may be absent. In N.S.W. and Victoria it occurs in subalpine areas whereas *D. affinis* is mainly alpine, above 1940 m. The spikelets of *D. innominata* resemble those of *D. parviseta* var. *boormanii* Vick. but in the latter species the whole plant is much larger with longer, flat leaves and the panicle 12–20 cm long with spreading branches. Tasmanian material held at NSW has been compared with material from Victoria and N.S.W. by Mrs J. Thompson who agrees that Tasmanian plants and those from the mainland are conspecific (pers. comm.).

PENTAPOGON R. Br.

When Brown (1810) created the genus *Pentapogon* he quoted *Agrostis quadrifida* Labill. as a synonym for his single species *Pentapogon billardieri* R. Br. Bentham (1877) used Brown's *Pentapogon billardieri* and created the variety *parviflorus*. Baillon (1893) published the new combination *Pentapogon quadrifidus* based on *Agrostis quadrifida* Labill. but overlooked Bentham's variety. As the varieties are quite distinct it is necessary to retain variety *parviflorus* and to create the new combination.

Pentapogon quadrifidus* (Labill.) Baillon var. *parviflorus* (Benth.) D. Morris, *comb. nov.

BASIONYM: *Pentapogon billardieri* R.Br. var *parviflorus* Benth., Flora Australiensis 7: 573 (1877). HOLOTYPE: Recherche Bay, C. Stuart (K).

DISTRIBUTION:

Tasmania; East Coast, Mt Wellington, Central Highlands, South West, sea level to c. 1200 m, herb-grasslands, heath, alpine shrubberies, cliff faces, rock crevices, stream banks, cushion plant communities. Most common in the Central Highlands and South West. Apparently more common than *Pentapogon quadrifidus* var. *quadrifidus* in Tasmania.

POA L.

Poa jugicola* D. Morris *sp. nov.

Gramen perenne dense caespitosum vel laxe caespitosum et rhizomata effusa et stolones breves ascendentes emittens. *Folia* plerumque basi. *Vaginae* foliorum pallidae, plus minusque nitidae vel fuscae, pubescentes vel glabrescentes, vaginae superiores glabrae vel basi parce pubescentes. *Ligulae* 0.5–2.0 mm longae, truncatae vel obtusae, ad apices ciliolatae postice pubescentes. *Laminae* foliorum inferiorum usque ad 35 cm longae, tenues, molles, involutae, angulosae, glabrae vel parce pilosae, apicibus cucullatis, scabrellis. *Culmi* usque ad 95 cm alti, graciles, teretes, 2-nodati, folia multum excedens, nodis glabris. *Panicula* 10–25 cm longa, laxe contracta vel tandem effusa, rhachis angulosa, scabra; rami capillares, scabri, spiculae in extremitatibus ramulorum, pedicelli scabri. *Spiculae* 2–5-floratae, 4–7 mm longae, compressae, viridescens vel purpurascens. *Glumae* subaequales, c. 3 mm longae, acutae vel subacutae, gluma inferior 1–3-nervata, gluma superior 3-nervata, carinis modice vel valde scabris, paginis lateralibus glabris vel scaberulis, marginibus hyalinis. *Aranea* copiosa vel exigua vel obsoleta. *Lemma* 3.5–4.5 mm longum, oblongum vel lanceolatum, obtusum, deorsum ad carinam villosum, sursum scaberulum, nervis marginalibus deorsum villosis, nervis et internervis aliquando sursum scaberulis. *Palea* ad carinas sursum scabra vel scabro-ciliolata, deorsum laevis. *Antherae* c. 2.5 mm longae, flavescens vel purpurascens.

TYPUS: Tasmania, Quamby Bluff, 6 Mar. 1986, A. Moscal 12591, (HOLOTYPE: HO 96575; ISOTYPUS NSW).

Perennial, densely tufted or loosely tufted with spreading rhizomes and short ascending stolons. *Leaves* mostly basal. *Leaf-sheaths* pale and more or less shining or dull brown, pubescent or glabrous, upper sheaths glabrous or sparsely pubescent



Fig. 15. Holotype of *Poa jugicola*.

at the base. *Ligules* 0.5–2.0 mm long, truncate or obtuse, apex ciliolate, pubescent on the back. *Blades* of basal leaves up to 35 cm long, fine, soft, involute, angular, glabrous or sparsely pilose, apices cucullate, scaberulous. *Culm* up to 95 cm high, slender, terete, 2-noded, greatly exceeding the leaves, nodes glabrous. *Panicle* 10–25 cm long loosely contracted or spreading later, rhachis angular, scabrous, branches capillary, scabrous, the spikelets borne towards the ends of the branches, pedicels scabrous. *Spikelets* 2–5-flowered, 4–7 mm long, compressed, green or purplish. *Glumes* subequal, c. 3 mm long, acute or subacute, the lower 1–3-nerved, the upper 3-nerved, keels sparsely or strongly scabrous, lateral faces glabrous or scaberulous, margins hyaline. *Web* copious, sparse or obsolete. *Lemma* 3.5–4.5 mm long, oblong-lanceolate, obtuse, keels villous below, scaberulous above, marginal nerves villous below, nerves and internerves sometimes scaberulous above. *Palea* with keels scabrous or scabrous-ciliate above, smooth below. *Anthers* c. 2.5 mm long, yellow or purplish. (Fig. 15)

DISTRIBUTION:

Tasmania; Central Highlands and Midlands above 890 m. Among boulders or on dolerite outcrops in subalpine *Nothofagus cunninghamii* forest.

SPECIMENS EXAMINED:

Tasmania—Quamby Bluff, 2 Mar. 1986, A. Moscal 12546b (HO); Quamby Bluff, 6 Mar. 1986, A. Moscal 12592 (HO); Nells Bluff, 14 Mar. 1986, A. Moscal 12686 (HO); Higgs Track, Great Western Tiers, 27 Jan. 1988, D. Ziegeler s.n. (HO).

ETYMOLOGY:

Jugicola, dwelling in mountain ranges.

P. jugicola is distinguished by the presence of rhizomes, a rather lax tussock, fine soft glabrous leaves and a panicle usually looser and more spreading than that of *P. labillardieri*. The spikelets closely resemble those of *P. labillardieri*.

***Poa poiformis* (Labill.) Druce var. *ramifer* D. Morris var. nov.**

A var. *Poa poiformis* (Labill.) Druce var. *poiformis* nodis inferis ramiferis et vaginis internodiisque saepe purpurascens differt.

TYPUS: Tasmania, Southport Island, NE of Southport Bluff, 3 Dec. 1980, N. Brothers s.n. (HOLOTYPE: HO 36816; ISOTYPE MEL).

Differs from *Poa poiformis* var. *poiformis* in branching from the lower nodes and in the sheaths and internodes being often purple. The culm is frequently up to 2.5 mm in diameter at the lower internodes. In one specimen (HO 94717) a non-flowering culm is 13-noded. (Fig. 16)

DISTRIBUTION:

Tasmania; shores and offshore islands on the East Coast and Furneaux Group, Victoria.

SPECIMENS EXAMINED:

Tasmania—Sterile Island, 8 km E of Recherche Bay, 3 Dec. 1972, N. Brothers s.n. (HO 36894); Nine Mile Beach, near Point Bagot, 29 Dec. 1981, A. M. Buchanan 708 (HO); Snake Island, D'Entrecasteaux Channel, 18 Nov. 1984, K. Harris s.n. (HO 96981); Furneaux Group, Craggy Island, 6 Nov. 1972, J. S. Whinray (HO); Grown at Bridport from a specimen collected from North East Island, Kent Group, Jan. 1985, B. Bensemann s.n. (HO 97090).

Victoria—Glenaire Beach near Castle Cove, 21 May 1988, A. M. Buchanan 10939 (HO).

ETYMOLOGY:

Ramifer, branch-bearing, from the branching habit of the culms.

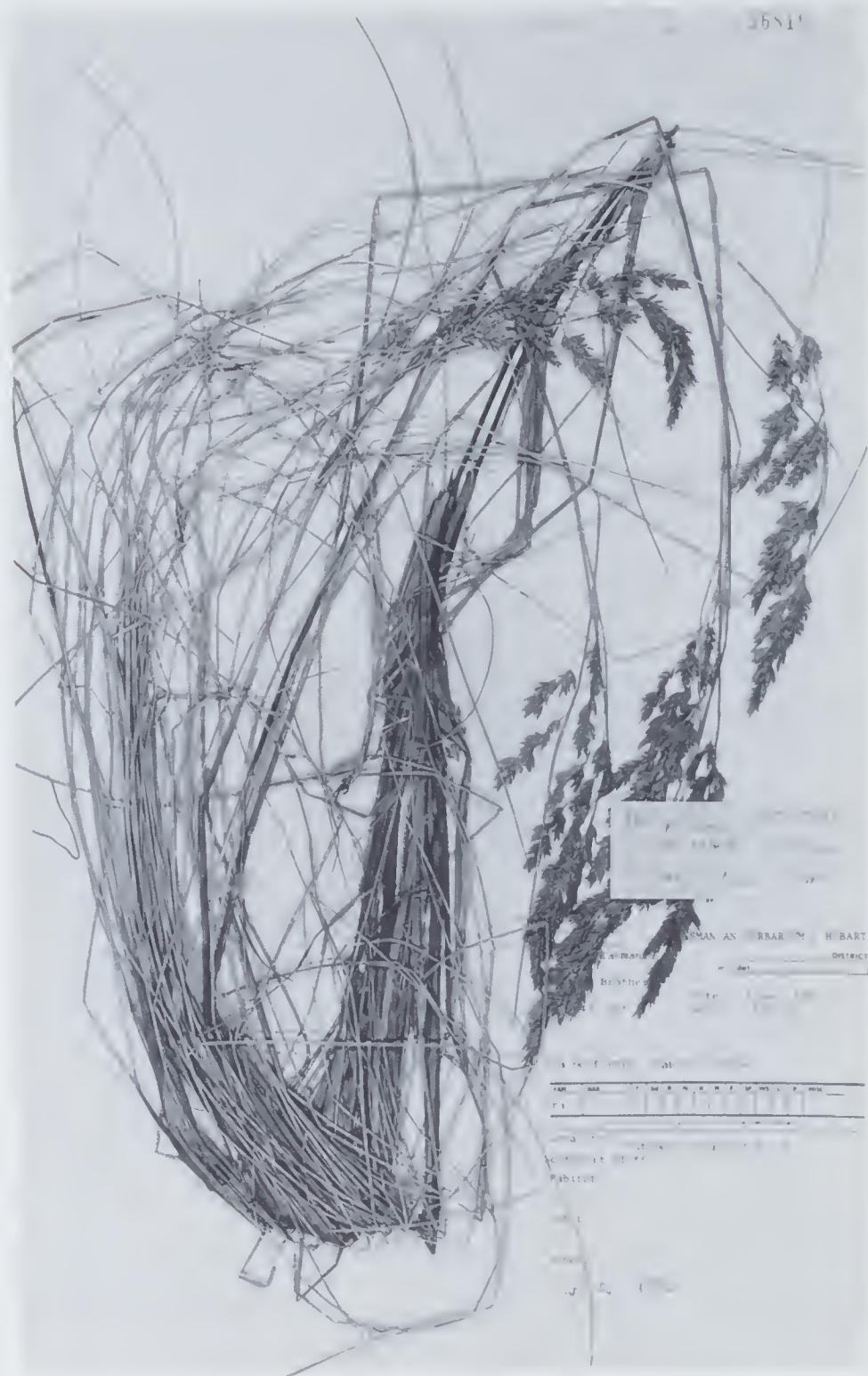


Fig. 16. Holotype of *Poa poiiformis* var. *ramifer*.

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SOME SPECIES OF *CLADONIA*, PUBLISHED BY J. D. Hooker & T. Taylor FROM THE SOUTHERN HEMISPHERE

by

TEUVO AHTI,* SOILI STENROOS* & ALAN W. ARCHER†

ABSTRACT

Ahti, Teuvo, Soili Stenroos & Alan W. Archer. Some species of *Cladonia*, published by J. D. Hooker & T. Taylor from the Southern Hemisphere. *Muelleria* 7(2): 173–177 (1990).—The taxonomy and nomenclature of some taxa of *Cladonia* (Lecanorales, lichen-forming ascomycetes) from the Southern Hemisphere are discussed. *Cladonia decurva* Taylor *ex* Church. Bab. & Mitten in J. D. Hooker (*nom. inval.*) is to be replaced by *C. scabriuscula* (Delise in Duby) Nyl., *C. squamosula* Müll. Arg. var. *squamosula* by *C. rigida* (J. D. Hooker & Taylor) Hampe var. *rigida*, *C. squamosula* var. *subsquamosula* A. W. Archer by *C. rigida* var. *acuta* (Taylor) A. W. Archer, *C. campbelliana* (Vainio) Gyelnik by *C. sarmentosa* (J. D. Hooker & Taylor) Dodge and *C. flavescens* Vainio by *C. ustulata* (J. D. Hooker & Taylor) Leighton. *C. phyllophora* (J. D. Hooker & Taylor) Dodge (*nom. illeg.*) probably represents an unnamed species close to *C. corniculata* Ahti & Kashiw. A new combination is *C. rigida* var. *acuta* (Taylor) A. W. Archer. A lectotype is selected for *C. sarmentosa* (J. D. Hooker & Taylor) Leighton. The major phenolic compounds of each taxon are presented.

INTRODUCTION

The following six species of *Cladonia* were published in the 19th century by J. D. Hooker and T. Taylor from the Southern Hemisphere (Hooker & Taylor, 1844; Hooker, 1847, 1860): *Cladonia decurva* Taylor *ex* Church. Bab. & Mitten, *Cenomyce acuta* Taylor, *C. phyllophora* J. D. Hooker & Taylor, *C. rigida* J. D. Hooker & Taylor, *C. sarmentosa* J. D. Hooker & Taylor and *C. ustulata* J. D. Hooker & Taylor. These species have been restudied by some authors, especially Vainio (1887, 1894), Müller Argoviensis (1888) and Dodge (1948), but the status of most of them has remained uncertain. A careful study of the original specimens turned out to lead to a number of taxonomical and nomenclatural changes, presented below. The phenolic products of the type material were analyzed by thin-layer chromatography (TLC; see Culberson 1972; White & James 1985).

TAXONOMY AND NOMENCLATURE

1. ***Cladonia decurva*** Taylor *ex* Church. Bab. & Mitten in J. D. Hooker, Fl. Tasm. 2: 350 (1860); *pro syn.* ORIG. COLL.: Australia. Tasmania ("Van Diemens Land"; BM; *vide* Filson 1986).

DISCUSSION:

C. decurva was listed under *C. squamosa* by Babington and Mitten (1860) as a herbarium name given by Taylor to specimens in Hooker's collection. A brief description was also given, which was later repeated by Vainio (1887, p. 429) in Latin. However, *C. decurva* was not definitely accepted by the authors of these publications, and therefore the name was not validly published. The species was not referred to by Leighton (1867) in his list of specimens from the Hooker Herbarium which were tested with potassium hydroxide, and *C. decurva* was not listed by Wilson (1892) although other references were made to the Flora Tasmaniae. The species

* Department of Botany, University of Helsinki, Unioninkatu 44, SF-00170 Helsinki, Finland.

† Division of Analytical Laboratories, P.O. Box 162, Lidcombe, New South Wales, Australia, 2141

was listed without comment by Wetmore (1963) in his Catalogue of the lichens of Tasmania. A specimen labelled "*Cladonia decurva* Taylor, W. H. Archer, Cheshunt", (NSW 171006), was also examined. Both specimens consist of tall, branched, mainly ecorticate podetia with open axils and contain fumarprotocetraric acid; they were identified as *C. scabriuscula* (Delise in Duby) Nyl.

2. ***Cladonia phyllophora*** (J. D. Hooker & Taylor) Dodge, B.A.N.Z. Antarct. Res. Exped. 1929–1931 Repts., ser B, 7: 132 (1948); *nom. illeg.* (later homonym of *Cladonia phyllophora* Hoffm., Deutschl. Fl. 2: 126. 1796).—*Cenomyce phyllophora* J. D. Hooker & Taylor, Hooker's London J. Bot. 3: 652 (1844). TYPE: Kerguelen's Land, (1843) J. D. Hooker (FH, SYNTYPE; H, photo ex FH); contains fumarprotocetraric and protocetraric acids and the substances Cph-1 and Cph-2.

Cladonia squamosa var. *nana* Müll. Arg., Flora, Jena 71: 19 (1888). TYPE: Homotypic with *Cenomyce phyllophora* J. D. Hooker & Taylor.

DISCUSSION:

The status of *Cladonia phyllophora* has been discussed by a few authors, but its identity is still uncertain, largely because of the very bad state of the type specimen and poor knowledge of the lichen flora of Kerguelen. In any case the epithet *phyllophora* is not applicable at species level in *Cladonia* because of the earlier *C. phyllophora* Hoffm., which is a quite different lichen.

Crombie (1877) synonymized the Kerguelen *C. phyllophora* with *C. acuminata* (Ach.) Norrlin, Müller Argoviensis (1888) placed it into *C. squamosa* var. *nana* and Vainio (1894) suggested (without seeing the material) that it is *C. subsquamosa* (Nyl. ex Leighton) Crombie. Dodge (1948) discussed it thoroughly and included it as a distinct species, *C. phyllophora*, which was supposed to belong to the *C. fimbriata* group.

None of these authors identified any chemical compounds in the type material of *Cenomyce phyllophora*. The presence of the fumarprotocetraric acid complex and the morphology of the specimen examined place it in the vicinity of *Cladonia corniculata* Ahti & Kashiw., which is widespread in the Southern Hemisphere (Ahti & Kashiwadani 1984; Filson & Archer 1986; Stenroos 1988). There are almost no podetia in the specimen examined, but they are described in the protologue and by Müller Argoviensis (1888). The descriptions correspond with the podetia in a later specimen from Kerguelen (1874, Eaton, H-NYL 39298) and another one from Marion Island (Hertel 24438, M, H), which probably belong to the same species. They are somewhat branched, with ascyphose tips and a granulose surface. They may represent a new species, but it must be left unnamed at the moment.

3. ***Cladonia rigida*** (J. D. Hooker & Taylor) Hampe var. ***rigida***.—*Cladonia rigida* (J. D. Hooker & Taylor) Hampe, Linnaea 28: 216 (1856).—*Cenomyce rigida* J. D. Hooker & Taylor, Hooker's London J. Bot. 3: 652. (1844).—*Cenomyce pyxidata* var. *rigida* (J. D. Hooker & Taylor) Taylor in J. D. Hooker, Crypt. Antarct.: 85 (1845). TYPE: New Zealand. Auckland Is. ("Lord Auckland's group"), dry turf soil, J. D. Hooker 1575 (LECTOTYPE: BM *fide* Galloway 1985; ISOLECTOTYPES: BM, FH, H-NYL 38432; H, photo ex FH); contains (the isolectotype in FH) thamnolic and decarboxythamnolic acids.

Cladonia squamosula Müll. Arg., Flora, Jena 66: 19 (1883); *syn. nov.* TYPE: Australia. Queensland, Toowoomba, 1882, Hartmann (HOLOTYPE: G; ISOTYPE: MEL 6551); contains thamnolic acid.

DISCUSSION:

The relationships of *C. rigida* have been discussed by several authors. Nylander (1860) and Dodge (1948) suggested that it was related to the group *Cocciferae*, and Vainio (1894) placed it near *C. pleurophylla* Vainio and *C. pityrophylla* Vainio. Müller Argoviensis (1888) referred it to *C. squamosa* (Scop.) Hoffm. Recently,

Galloway (1985) recognized *C. rigida* from Australasia as a distinct species; he differentiated *C. rigida* from *C. squamosula* by the presence of isidiate basal squamules. However, we found the original material of *Cenomyce rigida* to be morphologically indistinguishable from *Cladonia squamosula*, and as both contain thamnolic acid as their major phenolic compounds, the older name *C. rigida* must replace *C. squamosula* (var. *squamosula*). This strain with thamnolic acid only is known from Australia (Archer, 1986; as *C. squamosula*), New Zealand (Galloway 1985; as *C. squamosula* and *C. rigida*) and Chile (Ahti & Kashiwadani 1984; Stenroos 1987; as *C. squamosula*).

4. *Cladonia rigida* var. *acuta* (Taylor) A. W. Archer, *comb. nov.*—*Cenomyce acuta* Taylor, Hooker's London J. Bot. 6: 186 (1847).—*Cladonia squamosa* var. *acuta* (Taylor) Müll. Arg., Flora, Jena 71: 19. 1888.—*Cladonia acuta* (Taylor) Nyl. ex Hue, Nouv. Arch. Mus. Hist. Nat. Paris, ser. 3, 2: 32 (1890) [=Lich. Exot. 43: no. 291 (1892)]. TYPE: "Islands of the Pacific" ("Pacific" in label), Hb. Hooker (HOLOTYPE FH; H, photo ex FH); contains thamnolic, decarboxythamnolic and homosekikaic acids.

Cladonia squamosula var. *subsquamosula* A. W. Archer, Muelleria 6(5): 384 (1987); *syn. nov.* TYPE: Australia. New South Wales: Wentworth Falls, 90 km W of Sydney, 150° 22'E, 33° 45'S, alt. c. 900 m, 1985 Archer 1751 (HOLOTYPE: MEL 1048970; ISOTYPE: NSW); contains thamnolic and homosekikaic acids.

DISCUSSION:

This taxon was treated in detail by Archer (1987) as *C. squamosula* var. *subsquamosula*. The variety was distinguished from var. *squamosula* in containing homosekikaic acid (and traces of sekikaic acid; Huovinen & Ahti 1989) and having a more restricted distribution. However, the oldest name for the present taxon turned out to be *Cenomyce acuta* Taylor, the type material of which readily conforms with *Cladonia squamosula* both in morphology (i.e. it has densely squamulose podetia) and chemistry. *Cenomyce acuta* has been almost neglected since Vainio (1894) discussed it briefly under *Cladonia fimbriata* var. *chondroidea* subvar. *balfourii* (Crombie) Vainio, not being able, however, to identify it with certainty. Dodge (1948), giving a description of the characters, regards it as a distinct species but erroneously suggests it to be possibly related to *C. subdigitata* Nyl.

5. *Cladonia sarmentosa* (J. D. Hooker & Taylor) Dodge in B.A.N.Z. Antarct. Res. Exped. 1929-1931 Repts., ser. B, 7: 129 (1948).—*Cenomyce sarmentosa* J. D. Hooker & Taylor, Hooker's London J. Bot. 3: 651 (1844).—*Cladonia squamosa* var. *sarmentosa* (J. D. Hooker & Taylor) Müll. Arg., Flora 71: 18 (1888). LECTOTYPE (here selected): New Zealand. Auckland Is. ("Lord Auckland's group"), 1844, *J. D. Hooker 1569* (BM; ISOLECTOTYPE FH; LECTOPARATYPES BM, FH; H, photos ex FH); the isolectotype in FH contains fumarprotocetraric and protocetraric acids and the substances Cph-1 and Cph-2.

Cladonia gracilis var. *chordalis* subvar. *campbelliana* Vainio, Acta Soc. Fauna Fl. Fennica 10: 113 (1894).—*Cladonia gracilis* var. *campbelliana* (Vainio) Zahlbr., Catal. Lich. Univ. 4: 542 (1927).—*Cladonia campbelliana* (Vainio) Gyelnik, Rev. Bryol. Lichénol. 6: 174 (1933). TYPE: New Zealand. Campbell Island, 1874, *Filhol* (LECTOTYPE *fide* Ahti 1980 TUR-V 17645; ISOLECTOTYPES or LECTOPARATYPES BM, H-NYL 39328 and other nos., PC, PC-Hue, TUR-V 17644; the isolectotype in H-NYL contains fumarprotocetraric and protocetraric acids and the substances Cph-1 and Cph-2).

DISCUSSION:

This species has been generally referred to as *C. campbelliana*. Vainio (1887; 1894) discussed *Cenomyce sarmentosa* under *Cladonia squamosa* (Scop.) Hoffm., suspecting these two species to be conspecific. Müller Argoviensis (1888) definitely

referred to *C. squamosa* as var. *sarmentosa*. Dodge (1948) discussed the status of *C. sarmentosa* at length and correctly reduced *C. gracilis* var. *chordalis* subvar. *campbelliana* to its synonymy, though this synonymization was doubted by des Abbayes (1958) and Ahti (1980). As to the Macquarie Island material, Dodge (1948) applied *C. sarmentosa* to *C. coniocraea* sens. auct. (Filson & Archer 1986). *C. sarmentosa* is closely related to *C. ochrochlora* but differs by producing tiny squamules and coarse granules instead of true soredia, characteristic of *C. ochrochlora*.

C. sarmentosa has been reported (as *C. campbelliana*) from New Zealand (Galloway 1985), Australia (Filson, 1988), Japan, China, Java, Madagascar and Réunion (des Abbayes 1958), but is definitely known only from Australasia.

6. *Cladonia ustulata* (J. D. Hooker & Taylor) Leighton Ann. Mag. Nat. Hist., ser. 3, 19: 109 (1867).—*Cenomyce ustulata* J. D. Hooker & Taylor, Hooker's London J. Bot. 3: 652 (1844).—*Cenomyce fimbriata* var. *ustulata* (J. D. Hooker & Taylor) Taylor in J. D. Hooker, Fl. Antarct. 2: 531 (1847). LECTOTYPE (here selected): Falkland Islands. Uranie Bay, 1844, J. D. Hooker (BM; ISOLECTOTYPE FH; H, photo ex FH); the isolectotype contains thamnolic and decarboxythamnolic acids.

Cladonia flavescens Vainio in Hariot, J. Bot. (Morot) 1: 286 (1887); Acta Soc. Fauna Fl. Fennica 4: 197 (1887); syn. nov. TYPE: Chile. Cape Horn, "ad terram humosam", 1882–83, Hahn (HOLOTYPE PC; ISOTYPE TUR-V 14279); the isotype contains thamnolic and trace amounts of barbatic and usnic acids.

DISCUSSION:

This is a poorly known species, probably endemic to the southern South America. Vainio (1887 and in Hariot 1887) described it from the southernmost tip of Chile as *C. flavescens*, which was later discussed in detail by Ahti & Kashiwadani (1984). *Cenomyce ustulata* was described from the Falkland Islands. It was reduced to synonymy under *Cladonia fimbriata* var. *chondroidea* subvar. *balfourii* (Crombie) Vainio by Vainio (1894), while Dodge (1948; 1974) recognized it as a distinct species. Ahti (1978) suspected it to be possibly the oldest name at species level for *C. squamosa* var. *subsquamosa* (Nyl. ex Leighton) Crombie. However, though the authentic material of *C. ustulata* is very scanty, we found it to be indistinguishable from that of *C. flavescens* both in chemistry and morphology (e.g., the podetia are microsquamulose), and thus *C. ustulata* antedates *C. flavescens*. The specimens also favourably compared to recent material (H) of this species collected by S. Stenroos from Tierra del Fuego.

Thamnolic acid is the major phenolic compound of *C. ustulata* but barbatic acid as well as usnic acid may also be present (Ahti & Kashiwadani 1984).

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THE MYCORRHIZAL ASSOCIATIONS OF AUSTRALIAN INULEAE (ASTERACEAE)

by

J. H. WARCUP

ABSTRACT

Warcup, J. H. The mycorrhizal associations of Australian Inuleae (Asteraceae). *Muelleria* 7(2): 179–187 (1990). Some Australian Asteraceae form both ectomycorrhizal and vesicular-arbuscular mycorrhizal (VAM) associations; however, other species form only VAM. All Australian species known to form ectomycorrhiza appear to belong to the Inuleae, although the tribal relationships of *Isoetopsis graminifolia* Turcz. and *Chondropyxis halophila* D. A. Cooke have been subject to debate. Present data, although incomplete, suggest that in revised genera of Australian Inuleae all species have the same mycorrhizal system. An exception may be *Podotheca s.str.* The data suggest that knowledge of mycorrhizal association may be useful in considering relationships of taxa at generic and other levels.

INTRODUCTION

Warcup & McGee (1983) reported that some Australian Asteraceae, both in the field and in the laboratory, form both ectomycorrhizal and vesicular-arbuscular mycorrhizal (VAM) associations whereas other species are solely VAM. Species forming ectomycorrhizas were usually placed in the tribe Inuleae. The only exception *Isoetopsis graminifolia* Turcz. has also recently been referred to that tribe (Bremer 1987). Elsewhere reports of Asteraceae forming ectomycorrhizas are uncommon (Harley & Harley 1987) and are based on field data. The Australian data raise questions as to why some Asteraceae may form dual mycorrhizal associations (Ecto. + VAM) and whether in heterogeneous genera such as *Helichrysum* and *Helipterum* (Merxmüller, Leins, & Roessler 1977) the type of mycorrhizal association correlates with taxonomic relationship. The results of further investigations on the mycorrhizal associations of endemic Australian Inuleae are reported here.

METHODS

Evidence of mycorrhizal association was obtained mainly by growing seedlings of Inuleae inoculated with specific fungi, either ectomycorrhizal or VAM, in pots of an autoclaved sand-soil mix low in available phosphate. Soil-mix, method of inoculation and test fungi were generally those used previously (Warcup & McGee 1983). The unidentified ascomycete WARH24 was the main ectomycorrhizal fungus and *Glomus microcarpum* Tul. & Tul. the VAM partner. With a few species, notably *Podotheca angustifolia* (Labill.) Less., *Gnephosis sp. aff. skirrophora* and *Waitzia citrina* Steetz, a wider range of ectomycorrhizal fungi, including *Peziza whitei* (Gilkey) Trappe, *Labyrinthomyces varius* (Rodway) Trappe, *Elaphomyces sp.*, *Tomentella sp.*, *Laccaria ohiensis* (Mort.) Singer and *Sebacina vermifera* Oberwinkler (Warcup 1988b), were used successfully in ectomycorrhizal experiments.

Mycorrhizal experiments were done in a controlled growth room with a 12 hr day, a day temperature of 22° C and a night temperature of 18° C. The photosynthetic photon irradiance of 245 $\mu\text{mol m}^{-2}\text{s}^{-1}$ was measured at plant level under a bank of 15 Phillips TLK 65/80 W 33RS white tubes. All species formed VAM. Where possible ectomycorrhizal experiments were repeated if the original test was negative, but where few seedlings were available this was not always possible.

Department of Plant Pathology, Waite Agricultural Research Institute, University of Adelaide, Glen Osmond, South Australia, Australia, 5064.
Present address: 6 Seafield Avenue, Kingswood, South Australia, Australia, 5062.

RESULTS

While the mycorrhizal associations of Australian Inuleae were examined in general, work was concentrated on two groups the *Angianthus* group (*sensu* Merxmüller *et al.* (1977) and the *Helichrysum-Helipterum* complex. The first group of about 35 species is endemic in Australia and is concentrated in Western Australia with only a few species widespread across southern Australia. Most are annuals living in semi-arid to arid environments often on the margins of saline depressions (Short 1983). The *Helichrysum-Helipterum* group contains some 600 species mainly in Africa, Eurasia and Australia. The Australian species, about 160, are all or mostly endemic (Cooke 1986). They range from annual herbs to large shrubs, are widely distributed and occur in a wide range of habitats.

Table 1 gives data on mycorrhizal associations of the species of Inuleae investigated. Approximately 180 species representing 55 of the c. 80 inuloid genera currently recognised in Australia were examined.

Individual genera or generic groups are further discussed below but it is evident that the following general conclusions can be made:

- a. usually only single or dual mycorrhizal associations occur in any one genus; very often such genera have been recently revised [e.g. *Actinobole* (Short 1985), *Angianthus* (Short 1983), *Blennospora* (Short 1987b) and *Streptoglossa* (Dunlop 1981)]. *Podotheca*, also recently revised (Short 1989a) seems to be an exception.
- b. where both dual and single systems have been observed in the one genus, e.g. *Helichrysum* and *Helipterum*, the genus is usually well known to be a heterogeneous assemblage of species. Almost invariably, suggested segregate genera contain species with one type of mycorrhizal association, i.e. the data are useful for suggesting relationships of taxa.

DISCUSSION

ANGIANTHUS *s. lat.*

This genus was revised by Short (1983, 1989b). All tested species in *Angianthus s. str.* have dual mycorrhizal systems, as do the monotypic, segregate genera *Cephalosorus*, *Fitzwillia* and *Sondottia*. In contrast, other segregate genera examined (*Dithyrostegia*, *Epitriche*, *Hyalochlamys*, *Lemooria*, *Pogonolepis* and *Siloxerus*) are solely VAM.

GNEPHOSIS

This is an artificial genus. An array of inflorescence characters strongly suggests that a number of segregate genera should be recognised (Short 1987, pers. comm.) and this is reflected by the mycorrhiza data.

Gnephosis s. str. (*sensu* Short 1987) only contains species with the dual system, as do the four species of the segregate genus *Trichanthodium* (Short 1990). On the other hand *G. arachnoidea*, which should probably be referred to *Nematopus* A. Gray, is solely a VAM species. The placement of other single system species has not been entirely clarified although the inclusion of *G. pygmaea* with some species of *Myriocephalus* (probably *Myriocephalus s. str.*, see Short *et al.* 1989) is supported by the data.

PODOLEPIS

Investigations by Short *et al.* (1989) clearly show that this is also an unnatural genus although all species investigated have the dual mycorrhizal system.

PODOTHECA

This genus, recently revised (Short 1989a), has one species, *P. chrysantha*, which is solely VAM whereas the others are ectomycorrhizal + VAM. Seedlings were tested with isolate WARH24 on three separate occasions with the same result. There seems no doubt that this is a natural genus and further tests with different ectomycorrhizal fungi are desirable (Warcup 1988a).

CALOCEPHALUS

This is an unnatural group and a number of segregate genera should be recognized (Short 1986). *Blennospora* has already been reinstated (Short 1987b) and it only contains species with the dual mycorrhizal system, unlike tested species of *Calocephalus* (with the possible exception of *C. angianthoides*), which only have the VAM system. Similarly *C. brownii* (VAM) probably deserves recognition as the distinct genus *Leucophyta* (P. S. Short, pers. comm.).

HELICHRYSUM & HELIPTERUM

It is generally accepted that most, in fact probably all Australian species currently placed in *Helichrysum* and *Helipterum* (both *sensu* Bentham 1867) will be referred to a number of segregate genera (Wilson 1987, Short *et al.* 1989), e.g. *Chrysocephalum* Walp. and *Lawrencella* Lindley. Their establishment is supported by the presence of both single system species and dual system species in both genera, *Helichrysum* and *Helipterum*. Proposed segregate genera (P. G. Wilson, pers. comm.) usually contain species with the same type of system.

CASSINIA

There seems little to distinguish between this genus and *Ozothamnus* Benth. [in which many shrubby species of *Helichrysum* should be placed (P. G. Wilson, pers. comm.)]. It is perhaps significant that the species of *Cassinia* only have VAM systems, as do the ozothamnoid species of *Helichrysum*.

MYRIOCEPHALUS

The genus, as circumscribed by Bentham (1867), is clearly unnatural (Short *et al.* 1989) and this is reflected in the mycorrhiza data. *M. gracilis*, the only dual system species noted, has affinities with species currently included in *Helipterum* (P. S. Short, pers. comm.).

CHONDROPYXIS & ISOETOPSIS

Chondropyxis halophila was included by its author (Cooke 1986) in the Anthemideae but with the comment that, along with *Ceratogyne* Turcz., *Dimorphocoma* F. Muell. & Tate, *Elachanthus* F. Muell. and *Isoetopsis* it had closer affinities with the Astereae. Robinson and Brettell (1973) also considered that *Isoetopsis* was a member of the latter tribe, and not the Anthemideae in which it has been traditionally placed (Bentham 1867). On the other hand Turner (1970), on the basis of chromosome data, suggested that *Ceratogyne* and *Isoetopsis* might best be placed in the Inuleae. Bremer (1987) also remarked that unpublished work suggested that *Isoetopsis* is a member of the Inuleae (Subtribe Pluchiinae). The placement of *Chondropyxis* and *Isoetopsis* in the tribe Inuleae is supported by the mycorrhiza data as Australian members of other tribes of the Asteraceae do not seem to form ectomycorrhizas (Warcup & McGee 1983).

The data were collected to investigate whether in genera in the Inuleae considered taxonomically homogeneous all species had the same mycorrhizal system, i.e. all formed only VAM or all formed VAM and ectomycorrhizas. As all species investigated, and probably all species of Asteraceae, may form VAM, the important question is which species form ectomycorrhizas. The test used added fresh young mycorrhizal roots as inoculum of a test fungus to the tap root of a host seedling during transplanting to an autoclaved soil mix low in available phosphate. Where the host is capable of forming ectomycorrhizas fungal hyphae from the inoculum grow on to the roots and usually rapidly form ectomycorrhizas whose presence is indicated by increased growth of the host compared with uninoculated plants. Later the host is harvested and the roots checked for the presence of ectomycorrhizas. With time it became apparent that this was a simplistic approach to whether species may form mycorrhizas. While there appears little specificity of association between

hosts and fungi there is great variation in the number of mycorrhizas formed under different conditions (Warcup 1988a). Thus absence of mycorrhizas in a single test does not necessarily indicate whether a host is incapable of forming ectomycorrhizas. For this reason negative tests were repeated where possible but due to lack of material some species that form ectomycorrhizas may have been incorrectly assigned as solely VAM species. Whether all VAM species may, under certain conditions, form ectomycorrhizas is unknown. However, a few VAM species that were widely tested and observed in the field were always VAM; further, many species that form ectomycorrhizas formed them regularly in the presence of ectomycorrhizal fungi.

In families such as the Pinaceae and Fagaceae, which are consistently ectomycorrhizal (Harley & Harley 1987), all species in a genus form ectomycorrhizas. A few cases are known, however, where only one species in a genus not normally considered to be ectomycorrhizal has been reported with ectomycorrhizas in the field. Such reports are often with *Cenococcum geophilum* Fr. possibly because of its easily visible black hyphae. As this fungus may grow over the surface of roots of many plants it is difficult to assess in the absence of experimental work whether it forms functional ectomycorrhizas, i.e. gives host growth responses with the hosts with which it has been associated.

In the Asteraceae *Mycelis muralis* (L.) Dumort has one record of ectomycorrhiza in association with *C. geophilum* (Harley & Harley 1987). Also Read & Haselwandter (1981) found *Homogyne alpina* (L.) Cass. had some black ectomycorrhizal roots at one of three alpine sites in Austria at which "*Dyras octopetala* L. possessed typical ectomycorrhizas many of which were of the *Cenococcum* type and dominance of mycelium of this kind was reflected in the presence of fungi of this type on a number of herbaceous species." Without further information it is difficult to assess whether formation of ectomycorrhizas in *H. alpina* was a response to environmental conditions rather than being an innate character of the species. In the Australian studies, however, while individual plants of ectomycorrhizal species may form ectomycorrhizas, VAM or both in the field (Warcup & McGee 1983; McGee 1986) most species are consistently ectomycorrhizal, often with a range of fungi, in ectomycorrhizal syntheses in the laboratory.

What governs whether a species may form ectomycorrhizas remains obscure. Warcup (1988a) in the Australian Lobelioideae showed that perennial species were solely VAM whereas annual species of *Lobelia* and *Isotoma* formed both ectomycorrhiza and VAM. Thus no simple correlation occurred between mycorrhizal system and the characters presently used in classification. There is no correlation between mycorrhizal systems and whether plants are annuals or perennials in the Inuleae. An alternative explanation that species forming ectomycorrhizas are those that occur predominantly in habitats where other ectomycorrhizal hosts are abundant seems difficult to substantiate on present ecological data (Short 1981, 1983; Cooke 1986). Genera with solely VAM species, such as *Siloxerus*, *Ozothamnus* and *Pteropogon* may be common in habitats where other ectomycorrhizal hosts such as *Eucalyptus*, *Melaleuca*, *Casuarina* or *Acacia* are common. The limited data here, like the data for pines, oaks and beeches suggest a taxonomic, possibly genetic basis.

Table 1. Check-list of the occurrence of mycorrhiza in Australian Inuleae

Genus	Total No. species	Species Investigated	Source*	Mycorrhiza
ACTINOBOLE Fenzl. ex Endl.	4	<i>A. condensatum</i> (A. Gray) P. S. Short <i>A. uliginosum</i> (A. Gray) Hj. Eichler	Short 1005 Short 827	VAM VAM
AMMOBIUM R. Br.	1	<i>A. alatum</i> R. Br.	McGee	?VAM

Genus	Total No. species	Species Investigated	Source*	Mycorrhiza
ANGIANTHUS Wendl.	15	<i>A. acrohyalinus</i> Morrison	Short 1000	Ecto
		<i>A. cunninghamii</i> (DC.) Benth.	KP5730	Ecto
		<i>A. drummondii</i> (Turcz.) Benth.	KP5732	Ecto
		<i>A. glabratus</i> P. S. Short	Short 838	Ecto
		<i>A. micropodioides</i> (Benth.) Benth.		Ecto
		<i>A. preissianus</i> (Steetz) Benth.	Short 842	Ecto
		<i>A. milnei</i> Benth.	KP5740	Ecto
		<i>A. tomentosus</i> Wendl.	Short 1028	Ecto
APALOCHLAMYS Cass.	1	<i>A. spectabilis</i> (Labill.) J. H. Willis	L. D. Williams 10237	?VAM
ASTERIDEA Lindley	7	<i>A. athrixioides</i> (Sond. & F. Muell.) Kroner	Short 1756	Ecto
		<i>A. pulverulenta</i> Lindley	KP5758	Ecto
BELLIDA Ewart	1	<i>B. graminea</i> Ewart	Short 2176	VAM
BLENNOSPORA A. Gray	2	<i>B. drummondii</i> A. Gray	Short 1030	Ecto
		<i>B. phlegmatocarpa</i> (Diels) P. S. Short	Short 1077	Ecto
CALOCEPHALUS R. Br.	±14	<i>C. angianthoides</i> (Steetz) Benth.	Short 1043	VAM
		<i>C. francisii</i> (F. Muell.) Benth.	KP5793	VAM
		<i>C. platycephalus</i> (F. Muell.) Benth.	KP5799	VAM
CASSINIA R. Br.	±18	<i>C. laevis</i> R. Br.	JHW	VAM
		<i>C. aculeata</i> (Labill.) R. Br.	JHW	VAM
		<i>C. arcuata</i> R. Br.	JHW	VAM
CEPHALIPTERUM A. Gray	2	<i>C. drummondii</i> A. Gray	KP5817	VAM
CEPHALOSORUS A. Gray	1	<i>C. carpesioides</i> (Turcz.) P. S. Short	Short 2403	Ecto
CHONDROPYXIS D. A. Cooke	1	<i>C. halophila</i> D. Cooke	Haegi 2565	Ecto
CHTHONOCEPHALUS Steetz	4	<i>C. pseudevax</i> Steetz	KP5812	VAM
		<i>C. sp. aff. tomentellus</i>	Short 2111	VAM
CRASPEDIA Forst. f.	±20	<i>C. chrysantha</i> (Schl.) Benth.	JHW	VAM
		<i>C. globosa</i> (Bauer ex Benth.) Benth.	JHW	VAM
		<i>C. pleiocephala</i> F. Muell.	JHW	VAM
		<i>C. uniflora</i> Forst. f.	JHW	VAM
CRATYSTYLIS S. Moore		<i>C. subspinescens</i> (F. Muell. & Tate) S. Moore	KP5835	VAM
DECAZESIA F. Muell.	1	<i>D. hecatocephala</i> F. Muell.	Short 2049	VAM
DITHYROSTEGIA A. Gray	2	<i>D. amplexicaulis</i> A. Gray	Short 2398	VAM
EPALTES Cass.	4	<i>E. cunninghamii</i> (Hook.) Benth.	Badman 1722	VAM
EPITRICHE Turcz.	1	<i>E. demissus</i> (A. Gray) P. S. Short	Short 2391.	VAM
ERIOCHLAMYS Sond. & F. Muell. ex Sond.	1	<i>E. behrii</i> Sond. & F. Muell. ex Sond.	Short 833	Ecto
FITZWILLIA P. S. Short	1	<i>F. axilliflora</i> (W. V. Fitzg. ex Ewart & J. White) P. S. Short	Short 2188	Ecto
GNAPHALIUM L.	±30	<i>G. involucratum</i> Forst. f.	JHW	VAM
		<i>G. japonicum</i> Thunb.	JHW	VAM
GNEPHOSIS Cass. s.str.	6	<i>G. tenuissima</i> Cass.	Short 999	Ecto
		<i>G. multiflora</i> (P. S. Short) P. S. Short	Short 1046	Ecto
		<i>G. trifida</i> (P. S. Short) P. S. Short	Short 966	Ecto
		<i>G. drummondii</i> (A. Gray) P. S. Short	Short 1068	Ecto
		<i>G. uniflora</i> (Turcz.) P. S. Short	Short 1026	Ecto
GNEPHOSIS s. lato.	±17	<i>G. brevifolia</i> (A. Gray) Benth.	Haegi 2652	Ecto
		<i>G. gynotricha</i> Diels	Short 2031	VAM
		<i>G. foliata</i> (Sond.) Hj. Eichler	ADW59615	VAM
		<i>G. macrocephala</i> Turcz.	Short 1022	VAM
		<i>G. arachnoidea</i> Turcz.	ADW59615	VAM
		<i>G. eriocarpa</i> (F. Muell.) Benth.	Short 2997	VAM
		<i>G. acicularis</i> Benth.	Short 1015	Ecto
		<i>G. pygmaea</i> (A. Gray) Benth.	Haegi 2640	VAM

Genus	Total No. species	Species Investigated	Source*	Mycorrhiza
HELICHRYSUM Mill.	±100	<i>H. cordatum</i> DC.	KP5873	VAM
		<i>H. bracteatum</i> (Vent.) Willd.	CBG	Ecto
†'Lawrencella'		<i>H. davenportii</i> F. Muell.	KP5874	VAM
'Lawrencella'		<i>H. lindleyi</i> Hj. Eichler	KP5881	VAM
'Lawrencella'		<i>H. ayersii</i> F. Muell.	KP5868	VAM
'Lawrencella'		<i>H. subulifolium</i> F. Muell.	KP5890	VAM
†'Ozothamnus'		<i>H. antennaria</i> (DC.) Benth.	Tas.	VAM
'Ozothamnus'		<i>H. dendroideum</i> Wakef.		VAM
'Ozothamnus'		<i>H. diosmifolium</i> (Vent) Sw.	ADSG	VAM
'Ozothamnus'		<i>H. obcordatum</i> (DC.) Benth.	Tas	VAM
'Ozothamnus'		<i>H. rogersianum</i> J. H. Willis	ADSG	VAM
'Ozothamnus'		<i>H. parailium</i> (N. T. Burbidge)		
		W. M. Curtis	ADW47852	VAM
'Ozothamnus'		<i>H. ledifolium</i> (DC.) Benth.	ADSG	VAM
'Ozothamnus'		<i>H. hookeri</i> (Sond.) Druce	ADSG	VAM
'Ozothamnus'		<i>H. cuneifolium</i> Benth.	ADSG	VAM
'Ozothamnus'		<i>H. diotophyllum</i> F. Muell.	ADSG	VAM
†'Chrysocephalum'		<i>H. apiculatum</i> (Labill.) DC.	JHW	Ecto
'Chrysocephalum'		<i>H. semipapposum</i> (Labill.) DC.	ADSG	Ecto
'Chrysocephalum'		<i>H. ramosissimum</i> Hook.	McGee	Ecto
		<i>H. ambiguum</i> Turcz.	ADSG	?VAM
†'Blepharolepis'		<i>H. rutidolepis</i> DC.	McGee	VAM
'Blepharolepis'		<i>H. milliganii</i> Hook. f.	Tas	VAM
'Blepharolepis'		<i>H. podolepidium</i> F. Muell.		VAM
		<i>H. scorpioides</i> Labill.	JHW	VAM
		<i>H. blandowskianum</i> Steetz ex Sond.		Ecto
		<i>H. dealbatum</i> Labill.	CBG	Ecto
†'Leucochrysum'		<i>H. leucopsidium</i> DC.	McGee (1986)	Ecto
		<i>H. baxteri</i> Cunn. ex DC.		Ecto
HELIPTERUM DC.	±60	<i>H. manglesii</i> (Lindley) Benth.	Short 2153	VAM
		<i>H. tenellum</i> Turcz.	Short 2286	VAM
'Chrysocephalum'		<i>H. pterochaetum</i> (F. Muell.) Benth.	ADW55506	Ecto
†'Pteropogon'		<i>H. corymbiflorum</i> Schldl.	JHW	VAM
'Pteropogon'		<i>H. humboldtianum</i> (Gaudich.) DC.	KP5913	VAM
'Pteropogon'		<i>H. pygmaeum</i> (DC.) F. Muell.	KP5927	VAM
'Pteropogon'		<i>H. microglossum</i> (F. Muell ex Benth.)		
		Maiden & Betche	ADW59639	VAM
'Pteropogon'		<i>H. troedelii</i> F. Muell.	ADW59392	VAM
'Pteropogon'		<i>H. anthemoides</i> (Sieber ex Sprengel) DC.		VAM
'Pteropogon'		<i>H. chlorocephalum</i> (Turcz.) Benth.	Wilson 12299	VAM
'Pteropogon'		<i>H. roseum</i> (Hook.) Benth.	KP5929	VAM
'Pteropogon'		<i>H. splendidum</i> Hemsl.	KP5932	VAM
'Pteropogon'		<i>H. strictum</i> (Lindley) Benth.	Short 1581	VAM
'Pteropogon'		<i>H. oppositifolium</i> S. Moore	Wilson 12273	VAM
†'Monencyanthes'		<i>H. sp. aff. condensatum</i>	Short 2064	VAM
'Monencyanthes'		<i>H. maryonii</i> S. Moore	Haegi 2644	VAM
'Monencyanthes'		<i>H. uniflorum</i> J. Black	ADW45444	VAM
'Monencyanthes'		<i>H. moschatum</i> (Cunn. ex DC.) Benth.	ADW59335	VAM
†'Cephalipterum'		<i>H. sterilecens</i> F. Muell.	KP5933	VAM
		<i>H. verecundum</i> S. Moore	Wilson 12354	Ecto
		<i>H. ?spicatum</i> (Steetz) Benth.	Short 2131	VAM
		<i>H. battii</i> F. Muell.	Wilson 12299	VAM
		<i>H. margarethae</i> F. Muell.	KP5919	VAM
		<i>H. craspedioides</i> W. V. Fitz.	Short 2082	VAM
†'Leucochrysum'		<i>H. albicans</i> (A. Cunn.) DC.	ADSG	Ecto
'Leucochrysum'		<i>H. stipitatum</i> (F. Muell.) F. Muell.		
		ex Benth.	Short 2009	Ecto
†'Hyalosperma'		<i>H. cotula</i> (Benth.) DC.	JHW	Ecto
'Hyalosperma'		<i>H. demissum</i> (A. Gray) Druce	JHW	Ecto
'Hyalosperma'		<i>H. hyalospermum</i> F. Muell. ex Benth.	Short 1749	Ecto

Genus	Total No. species	Species Investigated	Source*	Mycorrhiza
'Hyalosperma'		<i>H. jessenii</i> F. Muell.	ADSG	Ecto
'Hyalosperma'		<i>H. praecox</i> F. Muell.	ADSG	Ecto
'Hyalosperma'		<i>H. venustum</i> S. Moore	KP5938	Ecto
'Hyalosperma'		<i>H. zacchaeus</i> S. Moore	Wilson 12302	Ecto
'Hyalosperma'		<i>H. pusillum</i> Turcz.	Wilson 12396	Ecto
		<i>H. floribundum</i> DC.	KP5906	VAM
HYALOCHLAMYS				
A. Gray	1	<i>H. globifera</i> A. Gray	Short 1006	VAM
ISOETOPSIS Turcz.	1	<i>I. graminifolia</i> Turcz.	Short 1764	Ecto
IXIOLENA Benth.	7	<i>I. supina</i> F. Muell.	Symon	VAM
		<i>I. brevicompta</i> F. Muell.	Haegi 2090	VAM
		<i>I. chloroleuca</i> Haegi	Haegi	VAM
IXODIA R. Br.	2	<i>I. achilleoides</i> R. Br.	McGee	?Ecto
LEMOORIA P. S. Short	1	<i>L. burkitii</i> (Benth.) P. S. Short	Haegi 2651	VAM
LEPTORHYNCHOS Less.	10	<i>L. squamatus</i> (Labill.) Lessing	JHW	Ecto
		<i>L. waitzia</i> Sond.		Ecto
LEUCOPHYTA Cass.	1	<i>L. brownii</i> Cass.	McGee	VAM
MILLOTIA Cass.	±5	<i>M. greevesii</i> F. Muell.	ADW55211	VAM
		<i>M. tenuifolia</i> Cass.	JHW	VAM
		<i>M. myosotidifolia</i> (Benth.) Steetz	Short 2128B	VAM
MYRIOCEPHALUS				
Benth.	±10	<i>M. stuartii</i> (Sond.) Benth.		VAM
		<i>M. nudus</i> A. Gray	Short 1004	VAM
		<i>M. guerinae</i> F. Muell.	Wilson 12257	VAM
		<i>M. rhizocephalus</i> (DC.) Benth	JHW	VAM
		<i>M. gracilis</i> (A. Gray) Benth.	Short 1018	Ecto
PLUCHEA Cass.	±5	<i>P. tetranthera</i> F. Muell.	Short 2029	VAM
		<i>P. rubelliflora</i> (F. Muell.) Robinson	Short 2079	VAM
PODOLEPIS Labill.				
s. lato	±20	<i>P. canescens</i> Cunn. ex DC.	KP6003	Ecto
		<i>P. gracilis</i> (Lehm.) Grah.	KP6006	Ecto
		<i>P. jaceoides</i> (Sims) Voss	JHW	Ecto
		<i>P. muelleri</i> (Sond.) G. Davis		Ecto
		<i>P. lessonii</i> (Cass.) Benth.	Short 2404	Ecto
		<i>P. kendalli</i> (F. Muell.) F. Muell.	KP6007	Ecto
		<i>P. rugata</i> Labill.	KP6011	Ecto
		<i>P. auriculata</i> DC.	Short 2033	Ecto
		<i>P. capillaris</i> (Steetz) Diels	Short 2136	Ecto
		<i>P. tepperi</i> (F. Muell.) D. Cooke	JHW	Ecto
PODOTHECA Cass. s.str.	6	<i>P. angustifolia</i> (Labill.) Less.	McGee	Ecto
		<i>P. gnaphalioides</i> Graham	Short 2129	Ecto
		<i>P. chrysantha</i> (Steetz) Benth.	KP6013	VAM
		<i>P. uniseta</i> P. S. Short	Short & Haegi 2642	?Ecto
		<i>P. wilsonii</i> P. S. Short	Short 2298	Ecto
POGONOLEPIS Steetz	2	<i>P. muelleriana</i> (Sond.) P. S. Short	Short 838	VAM
		<i>P. stricta</i> Steetz	Short 1009	VAM
PSEUDOGNAPHALIUM				
Kirpiczn.	1	<i>P. luteoalbum</i> (L.) Hilliard & B. L. Burt	JHW	VAM
PTEROCALON Elliot	6	<i>P. sphacelatum</i> (Labill.) Benth. & Hook. f. ex F. Muell.	KP6028	VAM
QUINETIA Cass.	1	<i>Q. urvillei</i> Cass.	JHW	VAM
QUINQUEREMULUS				
P. G. Wilson	1	<i>Q. linearis</i> P. G. Wilson	Short 2172	VAM
RUTIDOSIS DC.	±6	<i>R. leptorhynchoides</i> F. Muell.	JHW	Ecto
		<i>R. multiflora</i> (Nees) Robinson	JHW	Ecto
SCYPHOCORONIS				
A. Gray	2	<i>S. major</i> (Turcz.) Druce	Short 2011	VAM
		<i>S. incurva</i> D. Cooke	Short 2001	VAM

Genus	Total No. species	Species Investigated	Source*	Mycorrhiza
SILOXERUS Labill.	3	<i>S. filifolius</i> (Benth.) Ostenf.	Short 1056	VAM
		<i>S. humifusus</i> Labill.	Short 1055	VAM
		<i>S. pygmaeus</i> (A. Gray) P. S. Short	Short 1071	VAM
SONDOTTIA P. S. Short	1	<i>S. connata</i> (W., Fitzg.) P. S. Short	Short 1998	Ecto
STREPTOGLOSSA Steetz	8	<i>S. liatroides</i> (Turcz.) Dunlop	Symon	VAM
		<i>S. adscendens</i> (Benth.) Dunlop	Symon 14485	VAM
		<i>S. muelleri</i> Sond.	Whibley 7826	VAM
STUARTINA Sond.	2	<i>T. muelleri</i> (Sond.) Benth.	McGee (1986)	Ecto
TOXANTHES Turcz.	±3	<i>T. sp. aff. muelleri</i>	Short 2353	VAM
TRICHANTHODIUM				
Sond. & F. Muell. ex Sond.		<i>T. exilis</i> (W. V. Fitzg.) P. S. Short	Short 2151	Ecto
		<i>T. baracchianum</i> (Ewart & J. White) P. Short	Conn 2537	Ecto
		<i>T. skirrophorum</i> Sond. & F. Muell. ex Sond.	Short 2109	Ecto
		<i>T. scarlettianum</i> P. S. Short	Short 2106	Ecto
		<i>T. pygmaeus</i> Turcz.	JHW	Ecto
TRIPTILODISCUS Turcz.	1	<i>W. acuminata</i> Steetz.	KP6060	Ecto
WAITZIA Wendl.	7	<i>W. aurea</i> (Benth.) Steetz.	KP6061	Ecto
		<i>W. citrina</i> (Benth.) Steetz	KP6062	Ecto
		<i>W. suaveolens</i> (Benth.) Druce	KP6065	Ecto
		<i>W. podolepis</i> (Gaudich.) Benth.	KP6064	Ecto

* Seed from voucher specimens is referred to by collector number or by Herbarium number, KP seed was from the Kings Park (Perth) seed collection, CBG seed is from the National Botanic Gardens (Canberra), and AD SG seed was from members of the Australian Daisy Study Group.

† Segregates as suggested by P. G. Wilson

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NOTES ON AUSTRALIAN VERRUCARIACEAE (LICHENES): 1

by

P. M. MCCARTHY*

ABSTRACT

McCarthy, P. M. Notes on Australian Verrucariaceae (Lichenes): 1. *Muelleria* 7(2): 189–192 (1990).—*Verrucaria howensis* McCarthy, from Lord Howe Island, is described as new. Four other taxa are reported from Australia for the first time.

INTRODUCTION

The ill-considered description of numerous taxa, a consequent grossly-inflated synonymy and uncertainty over generic delimitation and relationships have inhibited the achievement of a comprehensive overview of the lichen family Verrucariaceae. A recent attempt to rationalise the situation in western Europe recognised 326 species of which 161 were attributable to the type genus (Clauzade & Roux 1985).

In contrast, the Australian experience has been one of almost total neglect. A number of the 16 taxa listed by Filson (1988) are doubtful, while four of the eight *Verrucariae* are marine species, the latter very much a peripheral group within the genus. Moreover, the number of specimens collected in Australia and confirmed as belonging to the family scarcely exceeds 200.

The present contribution derives from the examination of specimens in the National Herbarium of Victoria (MEL), most of which occurred fortuitously on rock fragments dominated by and filed under other lichen species.

TAXONOMY

1. *Verrucaria baldensis* Massal., Ric. Lich. Crost. 173 (1852).

Verrucaria baldensis is a cosmopolitan lichen formerly known as *V. sphinctrina* Ach., the latter name being applicable only to a foliicolous taxon. An obligately calcicolous species, *V. baldensis* has an endolithic thallus, immersed 0.2–0.3 mm perithecia and a lid-like and radically-fissured involucrellum. Already known from Western Australia and Victoria, the first records for South Australia and New South Wales are reported here.

SPECIMENS EXAMINED:

South Australia—Approximately 7 km E of Morgan, on Renmark Rd, 26.vii.1979, J. H. Willis (MEL 1045500).

New South Wales—48 km S of Braidwood, along Reedy Creek, Marble Arch, alt. 620 m, 2.iii.1978, J. A. Elix 4433 (MEL 1024404; filed as *Petractis clausa*).

2. *Verrucaria hochstetteri* Fr., Lich. Eur. 435 (1831).

Previously unknown in Australia, *V. hochstetteri* is almost invariably endolithic in limestone. The simple immersed perithecia measure 0.3–0.8 mm and the ellipsoid ascospores $20\text{--}48 \times 12\text{--}25 \mu\text{m}$. This lichen is common in most of Europe; it has also been reported from North Africa and New Caledonia.

SPECIMENS EXAMINED:

South Australia—Near Fowler's Bay, Colona Homestead, ?vii.1947, J. H. Willis (MEL 8741; filed with *Lecanora sphaerospora*).

Victoria—15 km E of Geelong, Point Wilson, ?iii.1980, A. Geddes (MEL 1029160; filed with *Dermatocarpon compactum*).

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

3. *Verrucaria howensis* McCarthy, sp. nov.

Thallus crustaceus, epilithicus, moderate expansus, continuus vel areolatus, obscure cinereo-viridis vel olivaceus, 0.04–0.08 mm crassus, sine prothallo distinguibili. *Areolae* regulares, angulares, laeves, planae aut raro leviter convexae, 0.1–0.2 (–0.25) mm latae. *Algae* virides, cellulis globosis, (5–) 6–10 μ m diametro. *Ascomata* perithecioida, semiimmersa vel fere superficialia, moderate numerosa, solitaria, prope basim thallo tecto. *Involucrellum* carbonaceum, nitidum, (0.1–)0.14(–0.2) mm diametro, 20–40 μ m crassum, expansum, dimidiatum vel usque ad basim excipuli descendens. *Ostiolum* inconspicuum aut leviter depressum. *Centrum* globosum, (0.08–)0.1(–0.13) mm diametro. *Excipulum* fuscoatrum, 10–15 μ m crassum, cellulis 6–8 \times 2–4 μ m. *Periphyses* 20–25 \times 1.5 μ m. *Paraphyses* desunt. *Asci* bitunicati, clavati, 8-spори, 17–25 \times 9–13 μ m. *Sporae* simplices, incolorate, ellipsoideae, (5.9–)7.3(–9.4) \times (3.2–)4.1(–5.0) μ m, contentis hyalinis vel subtiliter granulosis.

HOLOTYPE: New South Wales, Lord Howe Island, on calcareous tuff, ?x.1965, R. F. Steel 51 (MEL 10235).

Thallus crustose, epilithic, moderately wide-spreading, continuous to rimose or areolate, dull grey-green to olive-green, 0.04–0.08 mm thick, without a visible prothallus. *Areolae* regular, angular, smooth, plane or, rarely, somewhat convex, 0.1–0.2(–0.25) mm wide. *Algae* green, globose, (5–)6–10 μ m diam. *Ascomata* perithecioid, compound, semi-immersed to almost superficial, moderately numerous, solitary, often covered by a thalline collar towards the base. *Involucrellum* carbonaceus, glossy, 0.1–0.14(–0.2) mm diam., 20–40 μ m thick, dimidiate or extending to excipulum-base level. *Ostiole* inconspicuous or slightly depressed. *Centrum* globose, (0.08–)0.1(–0.12) mm diam. *Excipulum* brown-black, 10–15 μ m thick; cells 6–8 \times 2–4 μ m. *Periphyses* 20–25 \times 1.5 μ m. *Paraphyses* absent. *Asci* bitunicate, clavate, 8-spored, 17–25 \times 9–13 μ m. *Ascospores* simple, colourless, ellipsoid, (5.9–)7.3(–9.4) \times (3.2–)4.1(–5.0) μ m; contents clear to finely granulose. (Fig. 1)

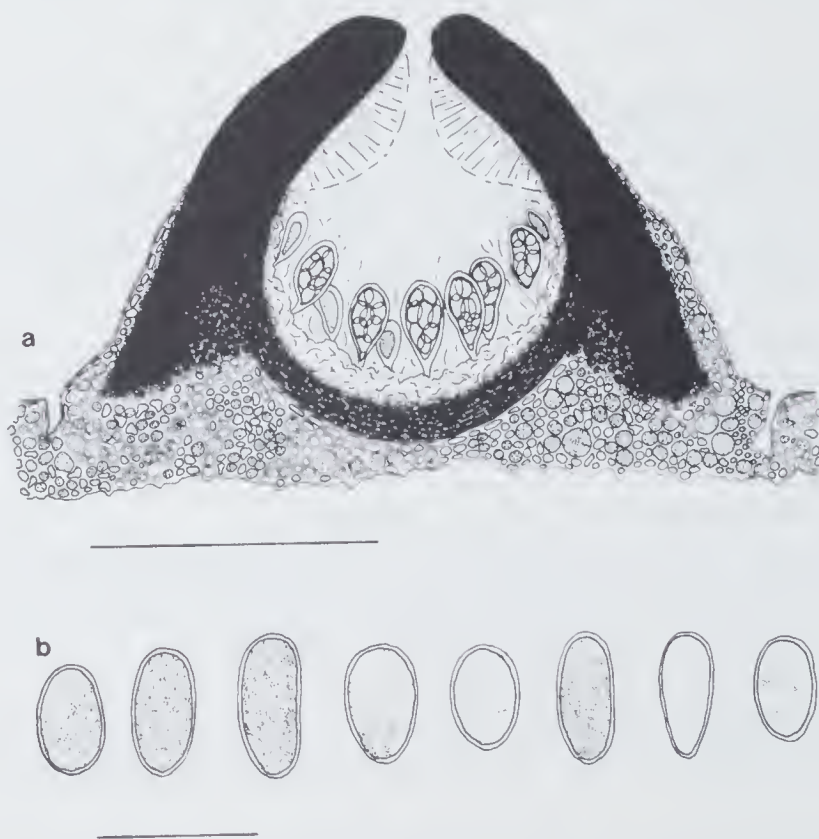


Fig. 1. *Verrucaria howensis*. a—vertical section of ascoma, scale 0.1 mm. b—ascospore, scale 10 μ m.

DISCUSSION:

In spite of the lack of precise information concerning the habitat of *V. howensis*, its association with *Physcia* sp. and *Lepraria* aff. *incana* suggests at least moderate shading in a non-marine and non-aquatic environment.

Minute-spored terrestrial *Verrucariae* represent a compact and comparatively manageable cluster of species. Most of the 13 saxicolous taxa described have localised known distributions ranging from northern Canada and Greenland, through western, central and northern Europe to the far-eastern USSR (McCarthy 1988a, b). The geographical disjunction introduced by *V. howensis* is, however, accompanied by a range of fundamental vegetative and ascomatal differences. While the strongest resemblance is to *V. bulgarica* Szat., the latter exhibits a medium to dark brown thallus, larger areolae, a non-spreading 20 μ m thick involucrellum, a generally paler excipulum and larger ascospores in asci measuring 25–35 \times 14–18 μ m.

4. *Verrucaria macrostoma* f. *furfuracea* B. de Lesd., Rev. Bryol. et Lichénol. 18: 71 (1949).

One of the few *Verrucariae* to produce clearly-defined asexual propagules, *V. macrostoma* f. *furfuracea* displays a thick pale brown to olive-green areolate to sub-squamulose thallus. Minute isidia develop along the margins of areolae and often erupt to form sorediate patches. Newly recorded from Australia, this lichen is also known from Great Britain and from central and southern Europe.

SPECIMEN EXAMINED:

Victoria—15 km E of Geelong, Point Wilson, ?iii.1980, A. Geddes (MEL 1029160; filed with *Dermatocarpon compactum*).

5. *Verrucaria nigrescens* Pers., Ulsteri's Annln Bot. 14: 36 (1795).

Predominantly a limestone-inhabiting species, *Verrucaria nigrescens* may also be found on shale, slate, calcareous sandstone and, more rarely, on hard siliceous rocks. The thallus is dark green to almost black, areolate, with the thallus and/or individual areolae edged by black prothalline hyphae. The 0.2–0.4 mm diam. semi-immersed perithecia have a thick, deeply-penetrating involucrellum and a brown-black excipulum. Most ascospores lie within the range 20–30 \times 10–14 μ m. It is a cosmopolitan species in Europe and is also known from northern Africa and North America.

SPECIMEN EXAMINED:

Victoria—Winslow, on limestone, 12.xi.1987, W. H. Ewers 1665 (MEL 1051984).

6. *Thelidium papulare* (Fr.) Arnold, Flora 68: 147 (1885). *Verrucaria papularis* Fr., Lichenogr. Europ. Reform. 434 (1831).

Thelidium is a poorly circumscribed genus. Traditionally characterised within the Verrucariaceae by its transversely-septate ascospores, this criterion loses definition as the genus appears to overlap both with *Verrucaria* and *Polyblastia*. Although represented in the floras of New Zealand and Antarctica, this is the first occasion on which *Thelidium* has been reported from Australia.

Thelidium papulare is a reasonably unambiguous entity. The thallus ranges from endolithic to subepilithic and the semi-immersed to almost superficial perithecia have a 0.4–0.7 mm diam. involucrellum and 3(–4)-septate ascospores of 30–50(–60) \times 14–22 μ m.

SPECIMEN EXAMINED:

New South Wales—48 km S of Braidwood, along Reedy Creek, Marble Arch, alt. 620 m, on limestone, 2.iii.1978, J. A. Elix 4433 (MEL 1024404; filed as *Petractis clausa*).

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EUCALYPTUS WIMMERENSIS, A NEW SPECIES OF *EUCALYPTUS* (MYRTACEAE) FROM VICTORIA AND SOUTH AUSTRALIA

by

K. RULE*

ABSTRACT

Rule, K. *Eucalyptus wimmerensis*, a new species of *Eucalyptus* from Victoria and South Australia. *Muelleria* 7(2): 193–201 (1990)—*Eucalyptus wimmerensis* K. Rule a sporadically distributed, relatively rare, mallee-box species of the Wimmera Region of Western Victoria and the Upper South East of South Australia is described and other mallee-box species with which it has been confused and/or has close affinities are discussed. Also discussed is its conservation status.

INTRODUCTION

An unnamed mallee-box eucalypt consists of a small number of concentrated populations which are scattered over a wide area in the Victorian Wimmera and adjacent areas of South Australia. These mallees are usually small-growing and characterised by semi-lustrous, relatively narrow adult leaves and smooth stems with occasional fibrous basal bark.

In the past these populations have been perceived as either *E. viridis* R. T. Baker or *E. odorata* Behr ex Schldl. Blakely (1965), in his circumscription of the genus, was under the impression that populations in the Dimboola area and other unspecified parts of the Wimmera belonged to *E. odorata* and cited them in his account of that species. Later, Willis (1973) made a brief reference to a population in the Lawloit Range between Nhill and Kaniva as being *E. viridis*, but conceded that its mallees possessed broader adult leaves and larger fruits than was typical for that species. Subsequent authors dealing with Victorian eucalypts have retained these mallee populations under the umbrella of *E. viridis*, as their distribution maps have clearly indicated. These include Costermans (1981), Brooker and Kleinig (1983) and most recently Chippendale (1988) in *Flora of Australia*.

The same level of confusion has prevailed in South Australia. Specimens of this unnamed mallee-box have been collected in the Bordertown area and recognised as *E. viridis*. However, only a few authors, through distribution maps, have acknowledged this; these were Goodman (1973) and Chippendale (*l.c.*). Yet other collections of the same mallee-box from the same area have been diagnosed as *E. odorata*. To say the least, such misidentifications are perplexing as markedly contrasting rough-barked trees comparable with typical *E. odorata* are not uncommon in the area. Chippendale and Wolf (1981), however, recognise the presence in the area of *E. odorata* var. *angustifolia* Blakely, a poorly defined taxon, whose type specimen was collected from the Eyre Peninsula, but made no reference to *E. viridis*. Later Chippendale (*l.c.*) discarded that taxon in his *Flora of Australia* treatment. Presumably they had been referring to the unnamed mallee-box.

Despite a history surrounded by neglect, confusion and obscurity, clear evidence accumulated using comparative studies with seedlings and cultivated specimens and from detailed examinations in the field, strongly confirms that this mallee-box eucalypt is a distinct species.

TAXONOMY

Eucalyptus wimmerensis K. Rule *sp. nov.*

Species nova ad Eucalyptum seriem Subbuxalibus pertinens. Frutex cortice laevi vel raro fibroso ad basin, glaucedinem deficiens, folius plantularum cinereis vel thalassicis hebetibus, adultis erectus

* 6 Regal Court, Vermont South, Victoria, Australia 3133

olivaceis vel thallicis nitentibus, alabastris ad 6×4 mm leviter costatis, fructibus ad 6×6 mm leviter costatis.

HOLOTYPE: Victoria, Lawloit Range on the Western Highway between Nhill and Kaniva, $36^{\circ} 24' S$, $141^{\circ} 31' E$, 27.xii.1964, J. H. Willis s.n. (MEL).

Shrubby or slender mallees to 4 m or rarely taller mallees to 12 m, never a tree habit. *Branches* erect and foliage usually dense, particularly on shrubby specimens. *Bark* smooth to the ground, grey to brown, or stems of taller mallees with a short stocking of fibrous, tight greyish bark rarely higher than 1 m; with old bark deciduous in ribbons. *Seedling leaves* sessile, decussate, narrow-elliptical for the first 3 or 4 pairs, becoming shortly petiolate, alternate, linear-lanceolate to narrow-lanceolate or linear-oblong to narrow-oblong, dull, grey to blue-green, but never waxy, concolorous, tapering at the base, acute or acuminate, semi-erect, 6.5×1.6 cm. *Intramarginal and lateral veins* visible but not conspicuous. *Juvenile leaves* alternate, petiolate, similar in shape to seedling leaves, dull, semi-erect, reaching adult size by 4 to 9 pairs. *Adult leaves* petiolate, linear-lanceolate or linear-oblong to narrow-lanceolate or narrow-oblong, sometimes slightly falcate, olive-green to blue-green, semi-lustrous, with older leaves lustrous, acute or acuminate, uncinat, erect in relation to the axis, with tapered bases, slightly sclerophyllous, to 8.0×1.5 cm. *Petioles* to 1.3 cm long, slightly flattened. *Intramarginal and lateral veins* visible but not conspicuous. *Intramarginal veins* less than 2 mm from margins. *Oil glands* abundant. *Branchlets* slightly angled. *Inflorescences* simple and axillary, either along the main axis or concentrated in leafless, terminal clusters. *Peduncles* slightly angled, to 1.3 cm long. *Floral buds* in umbels of (5-)7(-9-11), fusiform to clavate, subsessile to shortly pedicellate, not scarred, to 6×4 mm. *Sepaline and petaline opercula* adnate, conical or slightly obtuse, shorter than hypanthium. *Hypanthium* tapered into pedicel, slightly angled. *Flower colour* white. *Filaments* irregularly flexed, all fertile. *Anthers* adnate, basifixed, globoid, dehiscing by subterminal slits. *Style* to 5 mm long, with a blunt, disc-like stigma. *Fruit* with tapered base, subcylindrical, ovoid-truncate or cupular, lightly rugulose when dry, subsessile to shortly pedicellate, often burnished, to 6×6 mm. *Pedicels* slightly angled, relatively thickened in mature fruits, to 3 mm long. *Locules* (3-)4(-5). *Rim* thin but wall relatively thickened in mature fruits. *Disc* descending. *Fertile seeds* brown to dark brown, ovoid to \pm cuboid, ovate to elliptical in profile, dorsal surface shallowly reticulate, hilum ventral. (Fig. 1)

SPECIMENS EXAMINED:

Victoria—At the entrance to the Little Desert N.P., 7 km S of Kiata, $36^{\circ} 26' S$, $141^{\circ} 48' E$, D. Albrecht (MEL); Wonwondah North, 12 miles SW of Horsham, J. Smith Reserve, 26.ix.1969, A. C. Beauglehole 31002 (MEL); SW side of Mt Arapiles, 5.ix.1969, A. C. Beauglehole s.n. (MEL 531783); Sandplain W of Mt Arapiles, $36^{\circ} 48' S$, $141^{\circ} 42' E$ 23.viii.1979, M. I. H. Brooker (MEL 59870); 17 km NE of Gymbowen, $36^{\circ} 36' S$, $141^{\circ} 48' E$, 1.ix.1979, M. G. Corrick 6302 and B. A. Fuhrer (MEL); Gerang-Gerang, 2 km E on Western Highway, $36^{\circ} 22' S$, $141^{\circ} 54' E$, 15.x.1965, W. Middleton (MEL); Lawloit Range, on the Western Highway between Nhill and Kaniva, $36^{\circ} 21' S$, $141^{\circ} 31' E$, 25.v.1985, K. Rule 385 (MEL).

DISTRIBUTION (Fig. 2):

Field observations and herbarium collections indicate that *E. wimmerensis* has a scattered distribution over a wide area in the vicinity of Western Victoria's Little Desert and adjacent areas of South Australia. The areas of the Northern Little Desert, including adjacent farmland between Dimboola and Nhill, and the Lawloit Range between Nhill and Kaniva appear to contain the bulk of the populations. Collections have also been made near Bordertown in South Australia, in the heart of the Little Desert to the south of Nhill, near Mt Arapiles, in the malleelands to the SW of Horsham and in the Wyperfeld National Park. These outlying populations indicate an extensive distribution and raise the possibility of others existing in the intervening tracts and further afield.

The clearing of marginal land for farms has no doubt brought about the elimination or marked depletion of many populations of *E. wimmerensis*. By contrast, within the Little Desert there are substantial tracts of relatively inaccessible mallee



Fig. 1. *Eucalyptus wimmerensis*. a—branchlet, $\times 1$. b—adult leaf, $\times 2$. c—juvenile leaf, $\times 1$. d—buds just prior to anthesis, $\times 2$. e—anther, $\times 30$. f—style, $\times 7$. g—fruits, $\times 1$. h—fruits, $\times 2$. i and j—fertile seeds, $\times 10$.

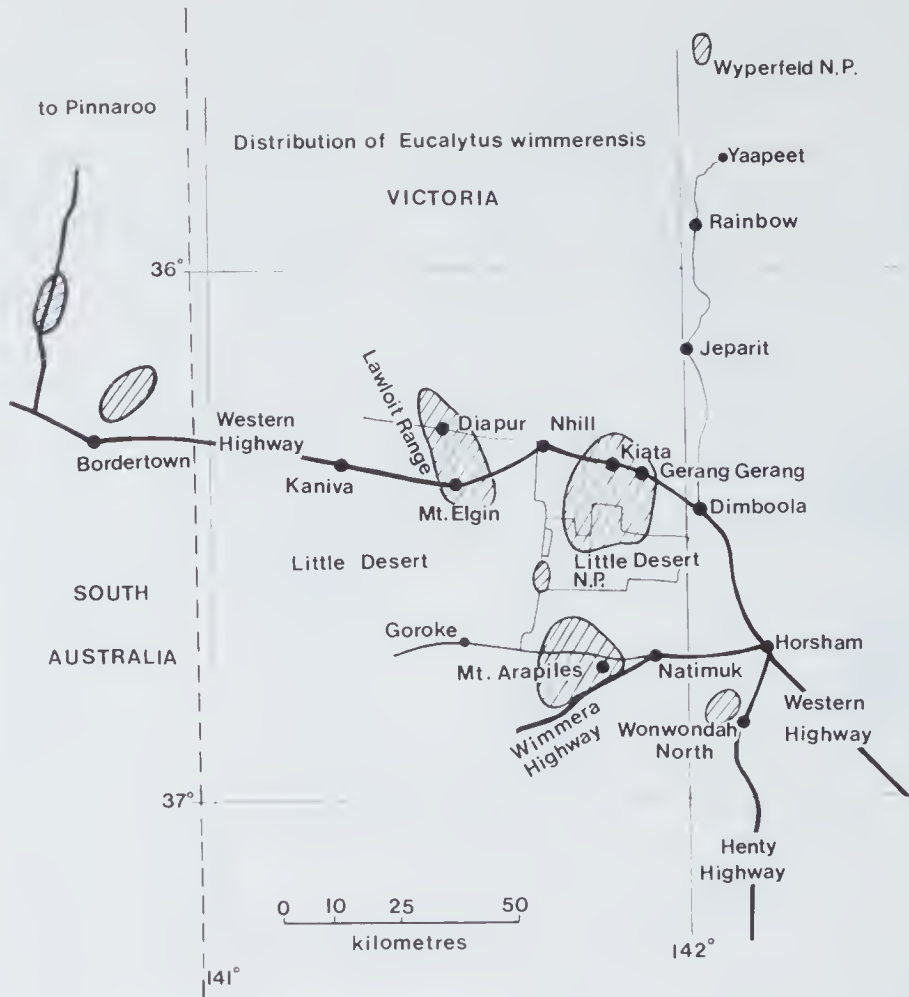


Fig. 2. Known distribution of *Eucalyptus wimmerensis*.

scrubland and it is highly likely that these areas harbour substantial numbers of the species.

E. wimmerensis tends to favour habitats featuring shallow sands or red-brown mallee loams over deep clays which may become water-logged in winter. However, in the Lawloit Range, which is a low sedimentary formation, where the type specimen was collected, the soils are well-drained gravelly-clays.

AFFINITIES:

Its adnate, basifixed anthers place *E. wimmerensis* in the informal Section *Adnataria* Pryor & Johnson. *E. wimmerensis* further possesses a range of features, both reproductive and vegetative, particularly the fused condition of its sepaline and petaline opercula, which places it firmly within the informal Series *Odoratae* Pryor & Johnson (alternatively Series *Subbuxuales* Blakely). More specifically, its seedling morphology indicates a position in Superspecies *Odorata* Pryor & Johnson adjacent to *E. odorata* and *E. polybractea* R. T. Baker.

The concept of the mallee-box was formally applied by Blakely (1965). In that sense the term implied a box species with a mallee habit and at least some basal bark. Pryor & Johnson (1971) redefined the terms of reference and devalued bark and habit in favour of reproductive characters. Their Series *Odoratae* included

E. odorata, *E. polybractea*, *E. froggattii* Blakely, *E. lansdowneana* F. Muell. & J. Brown, *E. porosa* F. Muell. ex Miq., *E. sparsa* Boomsma (then undescribed but coded) and *E. viridis*. Also included were two medium to tall forest species, viz. *E. argophloia* Blakely, an entirely smooth-barked species, *E. bosistoiana* F. Muell. Chippendale (1988) correctly employed the Series *Subbuxaeales* but transferred *E. lansdowniana* to another Series of box species. A summary the features which characterise the mallee-boxes is presented in Table 1.

Table 1. Common Features of Mallee-Boxes

Characters	Notes
Bark	Rough, fibrous, or flakey, usually on lower half of stem, smooth with deciduous ribbons above.
Juvenile Leaves	Decussate, sessile, becoming alternate, petiolate, concolourous or slightly discolourous, with no radical change in form from the seedling to adult stage.
Inflorescences	Axillary, simple, along the main axis but also in short apparently terminal leafless clusters.
Umbels	Buds (5-)7(-9-11)
Buds	Small and relatively inconspicuous, ovoid to clavate or fusiform, subsessile usually lightly angled; opercula fused, lacking outer operculum scar.
Anthers	Globoid to cuboid, small lateral or subterminal slits as pores.
Stamens	All-fertile, irregularly flexed.
Fruits	Small and relatively inconspicuous, hemispherical to ovoid-truncate or cylindrical, disc descending, valves enclosed, sessile to shortly pedicellate.
Fertile Seeds	± cuboid with round, elliptical or ovate profile, dorsal surface shallowly reticulate, hilum ventral.

As noted above, *E. viridis* and *E. odorata* are two mallee-box species which figure prominently in the history of *E. wimmerensis* and this association is a reflection that it has some degree of affinity with each. *E. polybractea* is another species whose features indicate a significant level of affinity with the species. Features which permit critical distinctions and comparisons between *E. wimmerensis* and its presumed relatives are discussed below (see also Table 2).

E. wimmerensis frequently has been mistaken for *E. viridis* as both exhibit relatively narrow, semi-lustrous adult leaves and small, inconspicuous fruits. As well, Victorian populations of *E. viridis* invariably feature the mallee habit. Their distributions are not known to overlap and, no doubt, opportunities for meaningful comparisons have been difficult, thus contributing to the confusion. The nearest recorded population of *E. viridis* is at Wedderburn in North Central Victoria, approximately 150 km to the east of the Little Desert.

The linking of *E. wimmerensis* and *E. viridis* obviously has had its source in similarities in adult characters. However, criteria for determining any eucalypt's taxonomic status or affinities should not involve such characters applied in isolation as there is always the possibility that substantial differences in the juvenile state may be masked. The case of *E. wimmerensis* and *E. viridis* is no exception. The juvenile leaves of *E. wimmerensis* differ from those of *E. viridis* in that they are broader, duller and differently coloured, the latter's being linear, semi-lustrous and green to dark green.

At a less conspicuous level, the two species are different in their adult morphology. *E. wimmerensis* has broader leaves, but those of *E. viridis* are copiously dotted with oil glands and have very faint intramarginal veins and no apparent lateral veins, features which do not apply to *E. wimmerensis*. Their fruits also differ as those of *E. viridis* are usually smaller and never ribbed. Further, they possess short, distinct, slightly slender pedicels which contrast subtly from the slightly thickened, tapered ones of *E. wimmerensis*.

Table 2. Comparative Features of *E. wimmerensis* and its Relatives

Characters	<i>E. wimmerensis</i>	<i>E. odorata</i>	<i>E. polybractea</i>	<i>E. viridis</i>
Juvenile Leaves				
Colour	grey to blue-green, dull	grey-green to blue-green, dull	grey to blue-green, dull	green, semi-lustrous
Surface wax	absent	absent	present	absent
Size	to 6.5×1.6 cm	to 7.5×3.0 cm	to 10.0×1.5 cm	to 11×0.6 cm
Secondary venation patterns	visible, not conspicuous	conspicuous, with minor network often visible	visible, but not conspicuous	not readily observable
Adult leaves				
Colour	olive-green to blue-green, semi-lustrous	grey-green to olive-green, dull	grey to grey-green, dull	green to dark green, semi-lustrous or lustrous
Leaf bud surface wax	absent	absent	present	absent
Size	to 8.0×1.5 cm	to 12.0×2.0 cm	to 8.0×1.5 cm	to 6.0×0.8 cm
Petiole length	to 1.3 cm	to 1.7 cm	to 1.5 cm	to 0.5 cm
Secondary venation patterns	visible	usually conspicuous	visible	not visible
Intramarginal vein distance from edge	< 2 mm	± 2 mm	< 2 mm	± 1 mm (if visible)
Floral Buds				
Surface wax	present	absent	present	absent
Angles/Ribbing	slightly angled	slightly angled	faint ribbing	absent
Pedicle length	to 5 mm	to 7 mm	to 7 mm	to 5 mm
Peduncle length	to 1.3 cm	to 1.0 cm	to 1.2 cm	to 0.9 cm
Size	to 6×4 mm	to 8×5 mm	to 6×4 mm	to 4.5×3 mm
Fruit				
Angles/Ribbing	slightly angled	slightly angled	faint ribbing or smooth	smooth
Pedicle length	to 3 mm	to 4 mm	to 5 mm	to 3 mm
Size	to 6×6 mm	to 8×6 mm	to 6×5 mm	to 5×4 mm
Bark	smooth or rarely basal, fibrous	chunky fibrous stocking to at least major branches	fibrous stocking confined to base or lower stem	fibrous stocking, confined to lower stem
Habit	small or rarely medium mallees	occasionally small to medium mallees, more often small to medium trees	small to medium mallees or slender trees	small mallees or small slender trees
Flowering time	summer to late autumn	autumn to early spring	autumn to winter	summer to autumn

E. odorata, the other species with which *E. wimmerensis* has been confused, is mainly South Australian in such areas as the Eyre Peninsula, the Flinders and Lofty Ranges, the Fleurieu Peninsula, Kangaroo Island and the Upper South East. A few collections comparable with the typical form have been made in the Wimmera, mainly close to the South Australian border. However, most collections attributed to *E. odorata* from that region represent misidentifications of *E. wimmerensis*, as studies of collection sites and herbarium specimens confirm. Collections from North Central Victoria also have been attributed to *E. odorata*. These, however, are neither that species nor *E. wimmerensis*, but represent an anomalous box superficially resembling *E. odorata* whose status and origins are as yet undetermined.

The confusion of *E. wimmerensis* with *E. odorata* has stemmed from similarities in bud and fruit morphology and from overlap in adult leaf widths. In particular, the fruits of *E. wimmerensis*, although marginally smaller than those of *E. odorata*, are practically inseparable in form, both having the same range of shapes, being slightly angled and having tapered, slightly thickened pedicels.

Rough, chunky, persistent bark to at least the major branches and usually a tree habit are features which readily distinguish *E. odorata* from *E. wimmerensis*. As well, *E. odorata* has duller and usually broader adult leaves which regularly exhibit a more conspicuous pattern of venation. With regard to leaf sizes, *E. odorata* var. *angustifolia* has widths that might be confused with those of *E. wimmerensis*. In most respects, the juvenile leaves of both species are similar, being dull with much the same range of colours and exhibiting comparable but not identical patterns of venation, except those of *E. odorata* are usually broader, often reaching elliptical, ovate or lanceolate proportions.

E. polybractea, a species occurring in North Central Victoria and the Riverina of New South Wales, is another mallee-box closely related to *E. wimmerensis*. Differences in adult characters are obvious and, no doubt, have inhibited confusion between the two species. The current season's adult foliage of *E. polybractea* is dull and strikingly grey or grey-green, often carrying slightly waxy leaf buds. Nonetheless, they are similar in shape, size and venation pattern to *E. wimmerensis*. The floral buds also are often slightly waxy. Further, the fruits of *E. polybractea* are subtly different to those of *E. wimmerensis*, although similar in shape and size, they are smooth or rarely only very faintly ribbed and often have pedicels that are marginally longer and slightly more slender. Also, there are differences and similarities in juvenile leaves. Differences are limited to the extent that those of *E. polybractea* are usually slightly waxy and marginally longer than those of *E. wimmerensis*. On the other hand, the juvenile leaves of the two species are similar in colour and also exhibit patterns of venation that approximate each other.

There is some conjecture regarding the relationship between *E. wimmerensis* and *E. viridis*, with some observers maintaining that they are sister species. However, within this narrow mallee-box context, seedling morphology suggests the affinity between the two is not close as speculated, and this is further supported by subtle differences in adult characters, particularly leaves. It is my firm opinion that those similarities which have caused the two species to be confused with each other are superficial and indicative of an appreciable level of convergence in adult characters. Coming to terms with adult convergence has been a major problem in *Eucalyptus* taxonomy. This is best illustrated by the example of the informal Series *Foecundae* Pryor & Johnson where Brooker (1988) recognised that no less than seven species had been lost under *E. foecunda* Schauer because critical differences, particularly in juvenile leaves, had been ignored in favour of readily observable adult characters.

Similarities in particular aspects of juvenile leaf and fruit morphologies and, to a lesser extent, adult leaf morphology suggest that *E. wimmerensis* and *E. odorata* are closely related. Differences in bark, habit and adult leaf lustre suggest a level of divergence that does not detract from this affinity.

The level of affinity of *E. wimmerensis* with *E. polybractea* needs clarification. As indicated above, except for their surface wax and marginal differences in size, the juvenile leaves of *E. polybractea* do not vary markedly from those of *E. wimmerensis*. Of course, some observers might suggest that the two could be distanced from each

other on the basis of *E. polybractea* possessing surface wax. However, evidence of Boland (1979), Brooker (1986) and others suggests that the presence or absence of surface wax alone is insufficient in determining affinities, let alone segregating species. Whilst this evidence would indicate a close affinity based on similarities in juvenile leaves, adult characters permit greater insight. Although there are similarities in leaf venation patterns and fruit size and shape, appreciable differences leaf colour and lustre and marginal differences in fruit ribbing and pedicel morphology indicate a substantial level of divergence in adult characters. There is little doubt that the two species are closely related and that they would be positioned in the vicinity of each other within the Superspecies *Odorata* if Pryor and Johnson's informal linear classification were applied to this mallee-box context. It is also apparent from the level of divergence in the adult characters that *E. odorata* is an even closer relative.

KEY TO MALLEE-BOX SPECIES IN WESTERN VICTORIA AND ADJACENT REGIONS

1. Current season's adult leaves dull
 2. Bark fibrous, chunky, persistent, on half or more of the stem; adult leaves grey-green to olive-green; surface wax absent from all structures.....*E. odorata*
 2. Bark fibrous, basal or confined to lower half of stem; adult leaves grey to grey-green; surface wax often present on leaf and floral buds.....*E. polybractea*
1. Current season's adult leaves semi-lustrous or lustrous
 3. Adult leaves 8 mm wide or narrower, with lateral veins not visible, green to dark green; juvenile leaves linear, rarely broader.....*E. viridis*
 3. Adult leaves broader than 8 mm wide, with lateral veins visible, olive-green to blue-green or yellow-green to light green; juvenile leaves never linear
 4. Adult leaves olive-green to blue-green, 1.5 cm wide or narrower, with faint intramarginal veins less than 2 mm from margins.....*E. wimmerensis*
 4. Adult leaves yellow-green to light-green, usually broader than 1.5 cm, with conspicuous intramarginal veins 2 mm or greater from margins
 5. Buds and fruits square in section.....*E. froggattii*
 5. Buds and fruits round in section.....*E. porosa*

ASSOCIATED SPECIES:

E. wimmerensis tends to grow in pure stands, but sometimes is the most common species in mixed mallee communities and may be associated with a sprinkling of *E. calycogona* Turcz., *E. leptophylla* F. Muell., *E. incrassata* Labill., *E. dumosa* Cunn. ex Oxley and *E. anceps* (R.Br. ex Maiden) Blakely. *E. froggattii* also is an associate in the Horsham malleelands. An unnamed subspecies of *E. leucoxydon* F. Muell. is an occasional associate in north-western areas of the distribution and in the Little Desert, but is often found in pure stands in the vicinity, as is *E. arenacea* Marginson & Ladiges. There are several other species to be found within the range of *E. wimmerensis* but they occupy different habitats which do not favour mallee communities. Curiously, however, at Mitre Rock in the Mt Arapiles area, there is a hybrid swarm obviously derived from *E. microcarpa* Maiden. Even though no specimens of pure *E. wimmerensis* were observed in the immediate area, it is suspected as being the other parent. Other hybrids of *E. wimmerensis* have been observed. At the type locality there are several mallees whose characters strongly suggest an influence from *E. dumosa*, whilst in the Kiata area hybrids with the unnamed subspecies of *E. leucoxydon* have been observed where the two species abut.

FLOWERING TIME:

Summer to late autumn.

ETYMOLOGY:

The specific epithet recognises the Wimmera Region of Western Victoria where the bulk of the *E. wimmerensis* populations are naturally distributed and where the type specimen was collected.

CONSERVATION NOTES:

The populations along the farming belt to the north of the Little Desert are severely depleted and are restricted to roadside verges and remnants on private farms. The populations in the Lawloit Range, which appear to be the western extremity of the distribution, have been affected by clearing. The one from which the type specimen was collected is the most extensive remnant, being of several hundred plants on both private and public land. The populations in areas of Mt Arapiles and the Horsham malleelands are also depleted but small segments are secure protected reserves.

By contrast, numbers of *E. wimmerensis* are in relative abundance and quite secure within the Little Desert National Park, particularly in the area to the south of Kiata.

By some standards *E. wimmerensis* would be regarded as moderately rare, despite its distribution being relatively widespread and the prospects for the discovery of yet unrecorded populations quite good. However, its apparent rarity provides reasonable grounds to suggest that relevant conservation authorities take steps to protect whatever numbers they can. The type population in the Lawloit Range offers such an opportunity.

Although only a few populations of *E. wimmerensis* have been observed near Bordertown, it is possible that more will be recognised in time in adjacent localities. Thus, within South Australia, it should be regarded as rare. As is recommended in the Victorian case, the relevant authorities should take steps to protect these known populations.

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NOTES ON *HOVEA* R. Br. (FABACEAE): 4

by

J. H. ROSS*

ABSTRACT

Ross, J. H. Notes on *Hovea* R. Br. (Fabaceae): 4. *Muelleria* 7(2): 203–206 (1990).—*Hovea corrickiae* from western Victoria and north-eastern Tasmania is described as new.

HOVEA CORRICKIAE

Hovea corrickiae J. H. Ross *sp. nov.* affinis *H. longifoliae* R.Br. a qua foliis anguste ovatis vel ellipticis, 0.7–2 cm latis plus minusve planis, petiolis 0.4–1 cm longis, pedicellis 5–9.5 mm longis, bracteis 4.5–8 mm infra bracteolis insertis, pilis ramulorum juniorum et paginae inferioris foliorum circinatis vel crispis, et pagina interiore valvae leguminis glabra, differt.

TYPUS: Victoria, Western Grampians, Victoria Range Road, 0.6 km from its junction with Sawmill Track, 5 Sept. 1983, *M. G. Corrick 8602* (HOLOTYPUS: MEL; ISOTYPI: BRI, CBG, HO, K, NSW).

Shrub or slender tree to 5 m high, branchlets densely clothed with appressed to slightly spreading straightish or curled greyish or whitish hairs. *Leaves* spreading almost at right angles to the stem: lamina more or less flat on upper surface on either side of the depressed midrib, narrow-ovate or elliptic, (1.7–)3–11.4 cm long, (0.5–)0.7–2 cm wide, apex obtuse or acute, with a short mucro, upper surface dark green, glossy, glabrous apart from hairs along the midrib, venation not prominent, lower surface with some of the lateral veins raised and quite prominent, densely clothed with coiled or curled pale yellowish-white to rust-coloured hairs, the hairs obscuring the surface completely or confined to the veins and forming a pattern through which glabrous patches of lamina are visible; petiole 0.4–1 cm long, densely pubescent like the branchlet. *Stipules* narrow-ovate, up to 1.2 mm long. *Inflorescences* axillary, on densely pubescent peduncles up to 1 cm long and usually 2- or 3-flowered or the axis growing on to form a many-flowered leaf-bearing shoot up to 12 cm long. *Flowers* pedicellate, the pedicels 5–9.5 mm long, densely clothed with short straightish or curled hairs; bracteoles oblong, 1–2 mm long, obtuse apically, much shorter than the calyx-tube, inserted at the base of or a short distance below the calyx, densely pubescent like the pedicel and bract; bract 1–2 mm long, inserted 4.5–8 mm below the bracteoles. *Calyx* densely clothed with short dark curled hairs and longer greyish-white hairs or the hairs dark basally and greyish-white distally: 2 upper lobes 6–6.5 mm long including the tube 3–3.5 mm long, the 3 lower lobes 2.5–3.5 mm long. *Standard* 9.5–10.5 mm long, 11–13 mm wide, emarginate apically, pale to deep mauve or occasionally white, with a greenish-yellow basal flare; wings 8.5–10 mm long, 3.8–4.5 mm wide; keel petals 5.7–6.5 mm long, 2.2–3 mm wide. *Stamen-filaments* 4.5–5 mm long. *Ovary* sessile, 2–2.5 mm long, 2-ovulate, pubescent basally and along the suture. Pods shortly stipitate but stipe not exceeding the calyx, obliquely ovoid or ellipsoid or sometimes transversely elliptic, 1–2 cm long, 0.9–1.7 cm wide, densely clothed with appressed hairs externally when young, sparsely so when mature, glabrous internally. *Seeds* elliptic, plump, 5.5–6 mm long, 3.4–3.6 mm wide, 2.7–3 mm thick, dark brownish-black and often with an underlying yellow to reddish-brown mottle, hilum linear, the aril with a small raised lateral lip and extending for almost the length of the seed. (Fig. 1)

H. corrickiae has a disjunct distribution occurring in western Victoria and in north-eastern Tasmania (Fig. 2). In western Victoria the species is confined to areas

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.



Fig. 1. *Hovea corrickiae*. a—flowering twig, $\times 1$. b—surface of portion of stem showing indumentum, $\times 5$. c—pedicel showing basal bract inserted some distance below the paired bracteoles, $\times 4$. d—calyx opened out (upper lobes on right), $\times 4$. e—standard, $\times 3$. f—wing petal, $\times 3$. g—keel petal, $\times 3$. h—gynoecium, $\times 6$. i—fruiting twig, $\times 1$. j—seed, side view, $\times 4$. k—seed, hilar view, $\times 4$. a-h from holotype, *M. G. Corrick* 8602 (MEL); j and k from *M. McGarvie et al.* (MEL).

of high rainfall in the Victoria and William Ranges in the Grampians and in the nearby Black Range; in Tasmania it is recorded from the St Columba Falls State Reserve and from the Lower Marsh Creek, south-east of Gray. Two specimens, namely Staer (NSW 168532) and Staer (NSW 168533), are labelled as having been collected at Ferntree Gully and the You Yangs, Victoria, respectively. Such occurrences of this species are so unlikely that they are discounted; presumably the labels do not belong with the specimens.

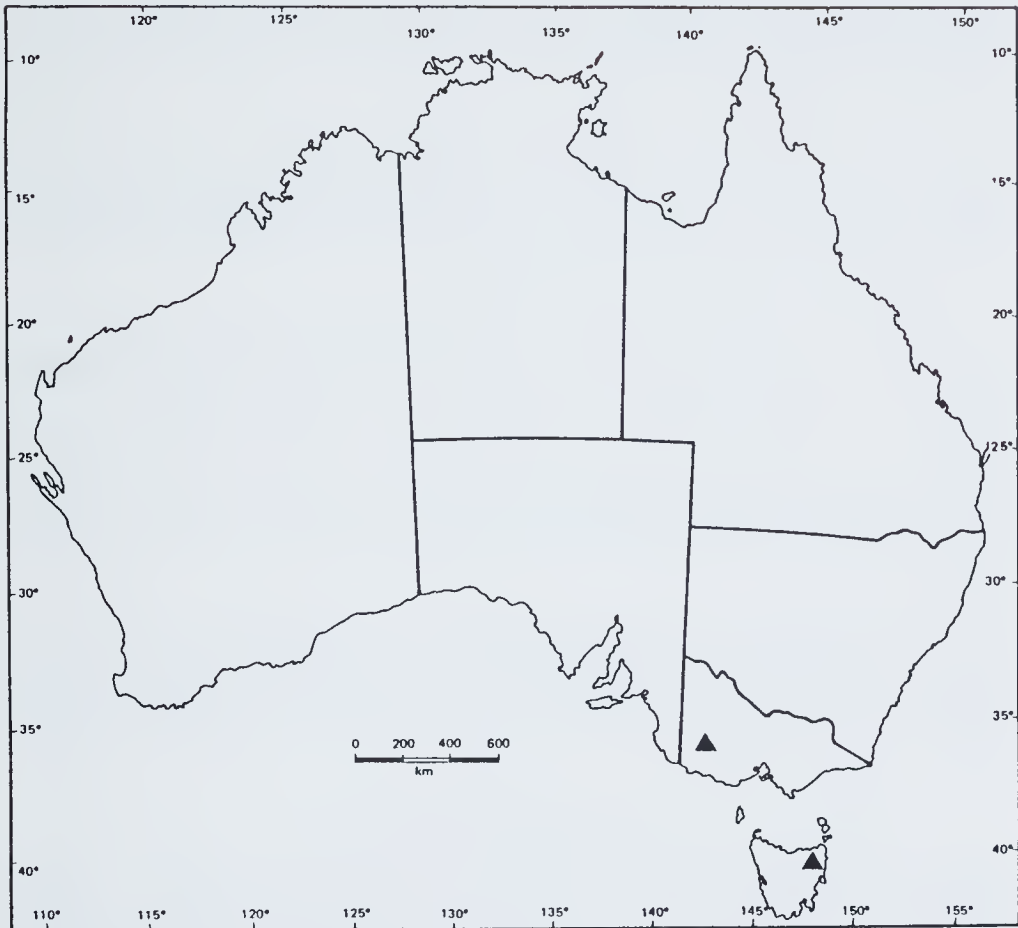


Fig. 2. The known distribution of *Hovea corrickiae*.

In Victoria the species favours tall open *Eucalyptus* forest (often *E. cypellocarpa* and/or *E. obliqua*) with a dense shrub layer. In Tasmania *H. corrickiae* is recorded from open *Eucalyptus* forest (*E. obliqua* and/or *E. sieberi*) and from *Acacia dealbata*–*Pomaderris apetala* or *Pomaderris apetala*–*Cassinia trinerva* dominated scrub.

REPRESENTATIVE SPECIMENS (total number examined 33):

Victoria—Grampians, Victoria Range, between Mt Thackery and Chimney Pot, along creek, feeder of Glenelg River, 24.ii.1957, *M. McGarvie, P. E. Finck & A. C. Beauglehole* 4075 (MEL). Grampians, Mt William Range, Bovine Falls, 4.x.1929, *J. H. Willis s.n.* (MEL 1529484). Black Range, 2.4 km SW of Knonargle's Hut at head of Muchong Creek, 4.iii.1948, *J. H. Willis s.n.* (MEL 1529481).

Tasmania—South George River, St Columba Falls State Reserve, 8.vi.1983, *A. Moscal* 2493 (HO). Lower Marsh Creek, 2.5 km SE of Gray, 16.v.1983, *D. Ziegler s.n.* (HO).

Material of *H. corrickiae* in Victoria has been referred previously (Willis 1973) to *H. longifolia* but the latter is a distinct species with a narrow range of distribution almost entirely within the central coastal area of New South Wales. *H. longifolia* differs from *H. corrickiae* in that the leaf-lamina is linear-oblong or oblong, 0.18–0.85 cm wide and usually arched up on either side of the midrib and slightly recurved, the pedicels are 4–6 mm long, the bract is inserted on the pedicel 1.5–4 mm below the paired bracteoles, the inner surface of each pod valve is clothed with weak white hairs, and the composition of the indumentum of the branchlets and lower surfaces of the leaves is different.

The indumentum on the branchlets of some specimens is reminiscent of that of *H. lanceolata* but in the latter species the bract and bracteoles are inserted close together on the pedicel.

Some specimens from Springbrook, Lamington National Park, Mt French and Mt Greville in south-eastern Queensland, for example *C. T. White* 6252 (BRI) and *D. & J. Orford s.n.* (MEL), are superficially similar to *H. corrickiae*. These Queensland specimens differ from *H. corrickiae* in having differently shaped calyx-lobes, wing and keel petals, and in the pods valves being pubescent internally. These specimens have been referred to in the past as narrow-leaved variants of *H. acutifolia* Cunn. ex G. Don but their identity is not clear at present.

Only seven specimens from Tasmania have been available for study, three of which are in young bud. Three of the specimens were collected before 1900 and cannot be localised accurately as locality data are deficient. The Tasmanian specimens differ slightly from the material from western Victoria in that the indumentum on the branchlets is slightly shorter and more tightly coiled, the indumentum on the lower surface of the leaves is slightly sparser and often discontinuous, the indumentum of the calyx is shorter, and the flowers are slightly smaller.

The upper surface of the leaves in *H. corrickiae* is glossy and in certain light the leaves shine and enable the species to be distinguished readily from the surrounding vegetation.

H. corrickiae is named in honour of my former colleague Margaret G. Corrick, who retired in October 1987, in recognition of her many contributions to botany. Margaret Corrick has had a long-standing interest in plants, especially in members of the family Fabaceae, and, together with her husband Bill, has travelled extensively and collected many specimens which have assisted work on this and other genera.

ACKNOWLEDGEMENTS

I am most grateful to my former colleague Margaret Corrick for making a special trip to collect type material of *H. corrickiae*; to Collin and Dorothy Woolcock of Portland for making a special collection of fruiting material of *H. corrickiae*; to my colleague Anita Podwyszynski for executing the illustration which accompanies this paper; to Alex George, Executive Editor of the Flora of Australia, Canberra, for checking the Latin diagnosis; and to the Directors/Curators of AD, BRI, CGE, E, HO, NSW, and W for the loan of specimens.

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TWO NEW SPECIES OF *POMADERRIS* Labill. (RHAMNACEAE) FROM NEW SOUTH WALES.

by

N. G. WALSH*

ABSTRACT

Walsh, N. G. Two new species of *Pomaderris* Labill. (Rhamnaceae) from New South Wales. *Muelleria* 7(2): 207–212 (1990).—*P. parrisiae* and *P. cocoparrana* from southern New South Wales are illustrated and described as new species. Their distribution, ecology and relationships to other species of *Pomaderris* are briefly discussed.

INTRODUCTION

This is the third recent paper by the present author describing new taxa in *Pomaderris*, toward a general review of the genus. The other articles appeared in *Muelleria* 6:6 and 7:1 (1988 and 1989 respectively).

TAXONOMY

Pomaderris parrisiae N. G. Walsh, *sp. nov.*

Species nova *P. andromedifolia* A. Cunn. affinis, a qua foliis majoribus, extremis ambabus acutibus, pilis subter foliis sparsioribus, et inflorescentibus laxioribus et latioribus differt.

TYPUS: New South Wales—South Coast, 0.6 km N of Pipers Lookout (Snowy Mountains Highway) along track to Rutherford Weir, 36° 35' S, 149° 27' E, alt. 820 m a.s.l., 18.x.1987, *M. Parris* 9217 (HOLOTYPE MEL 693093; ISOTYPE BRI, CBG, HO, NSW.).

Shrub to small, slender tree, to 9 m high. *Branchlets* and petioles covered by short, appressed, silvery hairs. *Lamina* elliptic to lanceolate, (2–)4–8 cm × (6–)10–25 mm, acute at base and apex; margins flat or slightly recurved; penninerved with 8–18 (mostly c. 12) pairs of lateral veins, secondary veins not apparent; upper surface green, entirely glabrous; lower surface silvery, closely covered with a fine stellate indumentum overlain, but not obscured by, short (c. 0.5 mm), appressed, simple hairs. *Stipules* lanceolate c. 5 mm long, keeled, early deciduous. *Inflorescence* mostly loosely paniculate, hemispherical to corymbose, 3–8 cm diam. *Pedicels* c. 5 mm long. *Sepals* oblong, acute, 2.5–3 mm long, spreading or recurved at anthesis, covered externally with a fine stellate tomentum which is largely obscured by a layer of longer silky, simple hairs, glabrous and creamy yellow on the inner surface. *Petals* ovate to deltoid with crenulate margins, narrowed at the base to a claw which is slightly shorter than the blade, the whole slightly shorter than the sepals, and pale yellow. *Staminal filaments* c. 2 mm long; anthers oblong, c. 1.5 mm long. *Style* c. 2 mm long, divided to about midway into 3 spreading arms. *Capsule* broadly ellipsoid, c. 4 mm long. *Seed* flattened ellipsoid-obloid, pale brown c. 2.5 × 1.5 mm, including the pale apical aril c. 0.5 mm long. (Fig. 1)

OTHER SPECIMENS EXAMINED:

New South Wales—From type locality—18.xi.1987, *M. Parris* 9216 (MEL 112564, CANB, CBG, NSW); 20.ix.1987, *J. D. Briggs* 2263, 2264 (MEL 1556040, MEL 1556041 resp., CANB, CBG, HO, NSW); 11.ix.1988, *N. G. Walsh* 2404 (MEL 1564744, CANB, NSW). *Southern Tablelands*—Brown Mountain, 7.x.1959, *E. Gauba* (CBG 016140); Wadbilliga National Park, Wadbilliga Fire Trail, 5.3 km SW from Wadbilliga R. crossing, 36° 17'30" S, 149° 34'10" E, alt. 900 m, 9.i.1987, *J. D. Briggs* 2186 & *M. Parris* (MEL 687157, BRI, CANB, CBG, NSW); Conways Gap, NE of Kybean, 36° 16'

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.



Fig. 1. *Pomaderris parrisiae* a—flowering twig, $\times 1$. b—leaf undersurface, $\times 1$; insert, $\times 4$. c—flower, $\times 8$. a–c from the holotype.

S, $149^{\circ} 33' \text{ E}$, alt. 900 m, 11.xi.1980, *I. R. Telford* 8566 (MEL 684712, CBG); Tantawangelo State Forest, Weir Track into Willbob Ck, 13 km SW of Bemboka, 4.xi.1983, *A. Nunnink* 559 (MEL 672077, NSW); Glenbog State Forest, Old Dam Road, 29.vii.1981, *D. Binns* 259 (NSW). South Coast—Coolangubra State Forest, southern escarpment of Big Jack Mountain, overlooking Stockyard Ck, $36^{\circ} 53' \text{ S}$, $149^{\circ} 27' \text{ E}$, alt. 800 m, 21.x.1986, *D. E. Albrecht* 2923 (MEL 689174, CBG, NSW); Ben Boyd National Park, along Green Cape Rd, 10.xii.1976, *A. Slee & M. Holgate* (MEL 687167, CANB); Egan Peaks Nature Reserve, Rock outcrop on the W. side, 1.5 km NW of Burragate Peak, $37^{\circ} 00' 30'' \text{ S}$, $149^{\circ} 49' 00'' \text{ E}$, alt. 560 m, 17.x.1986, *J. D. Briggs* 2084 (MEL 688147, CANB, CBG, NSW).

DISTRIBUTION AND CONSERVATION STATUS:

Most specimens are from the escarpment country falling from the eastern edge of the southern tablelands to the south coast area in the Kybean-Bemboka area, with a few southern outliers at lower altitudes.

The conservation status of the species is assessed to be 3VC- (Briggs & Leigh 1989, as *Pomaderris* sp. 3), that is, the species is vulnerable over a geographic range more than 100 km, is represented in a conservation reserve, but the total population size is not known. The conservation status of the species may require revision should areas currently supporting the species and contained within the NSW Woodchip Agreement Area (e.g. Tantawangelo, Glenbog and Coolangubra State Forests), be harvested for woodchips prior to a detailed assessment of the species total abundance and distribution.

HABITAT:

Specimens from the escarpment area are invariably associated with tall open-forests dominated by *Eucalyptus fastigata*, *E. smithii*, *E. cypellocarpa* or *E. nitens*, in some cases with elements of wetter forest types tending to cool-temperate rain-forest (with e.g. *Atherosperma moschatum*, *Elaeocarpus holopetalus*, *Tasmannia lanceolata*). Soils, where noted by collectors, are skeletal, overlaying granite or sediments. Specimens from southern localities (i.e. Albrecht 1923, Slee & Holgate s.n., Briggs 2084) appear to be from drier sites with shrubby or "dry sclerophyll" vegetation. Two of these collections are atypical, Albrecht 1923 having small (to 5 cm) leaves and Briggs 2084 having more compact inflorescences with deeper yellow flowers and a strikingly erect habit. These two specimens are for the present tentatively placed with *P. parrisiae*.

NOTES:

Specimens of *P. parrisiae* have in the past been referred to *P. andromedifolia* and *P. nitidula*. From *P. andromedifolia*, it can be distinguished by its generally larger leaves which are distinctly acute at both the base and apex, the indumentum of the abaxial leaf surface (which in *P. andromedifolia* is of a fine layer of stellate hairs more or less completely obscured by appressed, silky, golden hairs), and the larger and looser panicles. *P. nitidula*, a species of far northern N.S.W. and southern Queensland, bears a strong resemblance to *P. parrisiae* and is undoubtedly closely allied to it, but differs most significantly in having a dense, silky layer of white to pale golden hairs covering the undersurfaces of the leaves, with the lateral nerves immersed within and not protruding above this hair layer.

The specific epithet honours Mrs Margaret Parris of Merimbula who has been an avid and skilled collector and observer of plants in the N.S.W. south-coast area, and who first brought this taxon to my attention.

***Pomaderris cocoparrana* N. G. Walsh sp. nov.**

Species nova ab aliis speciebus generibus foliis relative brevibus, latus, cum pube simplice minuto pagina supera, et floreibus apetalis differt.

TYPUS: New South Wales—South Western Plains, Cocopara (sic) Range, summit of Mt Binga (=Bingar), alt. 1480 ft (c. 450 m) a.s.l., 28.ix.1969, J. H. Willis s.n. (HOLOTYPE MEL 503274; ISOTYPE NSW.)

Spreading shrub to 2 m high. *Petioles* and young branchlets bearing shortly spreading, golden to rusty stellate and simple hairs. *Lamina* broad-ovate, orbicular or broad-obovate, mostly 1–2.5 cm × 8–18 mm, obtuse (rarely acute) to slightly emarginate at apex; margins flat; penninerved with 5–12 (mostly c. 8) pairs of lateral veins, secondary veins not apparent; upper surface velvety, covered with extremely short (<0.1 mm), erect simple hairs; lower surface densely covered by fine, pale greyish stellate hairs, with some appressed, rusty simple hairs over the midrib and lateral veins. *Stipules* lanceolate c. 8 mm long, keeled, early deciduous. *Inflorescence*

paniculate, more or less pyramidal, comprising several sub-globular clusters, each commonly c. 1 cm diam, the whole inflorescence usually 2–4 cm diam. *Pedicels* 1.5–3 mm long. *Sepals* oblong, acute, c. 2 mm long, spreading at anthesis, covered externally with a fine stellate tomentum overlain by longer silky, simple hairs, which are produced beyond the apex as a small tuft, glabrous and pale golden-yellow on the inner surface. *Petals* absent. *Staminal filaments* c. 2 mm long; *anthers* oblong, c. 1.2 mm long. *Style* c. 1.5 mm long, divided for about 2/3 of its length into 3 spreading arms. *Capsule* ellipsoid, c. 4 mm long. *Seed* brown, flattened ellipsoid, angled along midline on ventral face, c. 2 × 1 mm, including the pale apical aril c. 0.5 mm long. (Fig. 2)

OTHER SPECIMENS EXAMINED:

New South Wales—from type locality—13.xi.1978, *G. M. Cunningham* 5505 & *P. L. Milthorpe* (MEL 1536519, NSW); 15.xi.1978, *G. M. Cunningham* 5649 & *P. L. Milthorpe* (MEL 1536520, NSW); 16.xi.1988, *N. G. Walsh* 2232 (MEL, CBG, NSW); Cocoparra Range, S end, north scarps of Mt Caley, 2.x.1969, *J. H. Willis s.n.* (MEL 91871); Duncans Ck, Cocoparra National Park, c. 30 km NE of Griffith, 34° 07' S, 146° 12' E, 20.ix.1978, *J. G. Brickhill* 24 (MEL 1536509, NSW); Store Dam Ck, Cocoparra Range, xi.1970, *E. Atkinson* (NSW 216574); Near Kangaroo Falls, Cocoparra Range, x.1970, *E. Atkinson* (NSW 216575).

DISTRIBUTION AND CONSERVATION STATUS:

The species is known only from the summit area of Mt Bingar, the highest point on the Cocoparra Range; Duncans Ck which drains Mt Bingar to the west (where rare); and slopes of Mt Caley about 9 km SE of Mt Bingar. It is likely to occur in similar sites at high elevations to the north and south of Mt Bingar but has not yet been located in these areas.

The conservation status of the species is assessed to be 2RCat, that is, the species has a geographic range of less than 100 km, is rare, has a total population exceeding 1000 individuals, and the entire population is included in a conservation reserve. This species was not recognized by Briggs and Leigh (1989), herbarium specimens to date having been included with *P. andromedifolia*.

HABITAT:

P. cocoparrana has been observed chiefly in shrubland or shrubby woodland formation, in rocky sites and on shallow soils derived from sandstone (or on deeper colluvium at Duncans Ck). Associated species include *Eucalyptus macrorhyncha*, *E. melliodora*, *E. sideroxylon*, *Callitris endlicheri*, *Calytrix tetragona*, *Dodonaea viscosa*, *Grevillea floribunda*, *Olearia tenuifolia*, *Persoonia curvifolia*. A population on the sheltered south-eastern slopes of Mt Caley observed in November 1988 consisted of a few plants germinated from seed following severe bushfires in 1986/87. No plants were located on the exposed 'north scarps of Mt Caley' the locality given on *Willis s.n.* (MEL 91871) and it is possible that this population has now succumbed to successive fires.

NOTES:

The affinities of *P. cocoparrana* have been suggested to be most closely with the widespread *P. andromedifolia*, a species which it slightly resembles in having appressed, silky hairs overlaying the fine stellate indumentum along the nerves on the lower surface of the leaves, but from which it is readily distinguished in the relatively broad and blunt leaves which are minutely pubescent on the upper surface and the apetalous flowers. *P. cinerea* and *P. brogoensis*, two species of restricted occurrence in the south-coast area of New South Wales, share the latter two characters with *P. cocoparrana* but are readily separable from it in having minute stellate (c.f. simple) pubescence on the surfaces of the upper leaves, and in the field, an overall dull or grey-green aspect. The geographic isolation from known occurrences of any other species of *Pomaderris* is of interest. Its occurrence at the Cocoparra Range probably represents the most inland penetration of any species in the genus.



Fig. 2. *Pomaderris cocoparrana* a—flowering twig, $\times 1$. b—flower, $\times 7$. c—leaf undersurface, $\times 10$. d—leaf T.S., $\times 20$. e—dehiscing capsule, $\times 7$. a-d from holotype; e from Cunningham 5505 & Milthorpe (MEL 1536519).

ACKNOWLEDGEMENTS

It is a pleasure to acknowledge the kind cooperation of Mrs Margaret Parris of Merimbula whose diligent collecting in the south-coast area of New South Wales has unearthed several botanical novelties, my colleague Anita Barley for providing illustrations of the new species, and the staff of CBG and NSW who forwarded *Pomaderris* specimens from those institutions.

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A REVISION OF *TRICHANTHODIUM* Sond. & F. Muell. ex Sond.
(ASTERACEAE: INULEAE: GNAPHALIINAE).

by

P. S. SHORT*

ABSTRACT

Short, P. S. A revision of *Trichanthodium* Sond. & F. Muell. ex Sond. (Asteraceae: Inuleae: Gnaphaliinae). *Muelleria* 7(2): 213–224 (1990). The endemic Australian genus *Trichanthodium* Sond. & F. Muell. ex Sond. is revised. Four species are recognized. One new species, *T. scarlettianum* P. S. Short from Western Australia, is described. Two new combinations are made: *T. baracchianum* (Ewart & J. White) P. S. Short and *T. exilis* (W. V. Fitzg.) P. S. Short. Chromosome numbers ($n = 3,4,7$) are reported for all species and evolution of the group is briefly discussed.

INTRODUCTION

Bentham (1867), in his treatment of the Compositae of Australia, generally adopted broad generic concepts, reducing genera recognized by botanists such as Henri Cassini, Asa Gray, Joachim Steetz and Nicholas Turczaninow to synonymy. Many such genera have been, or should be, reinstated (e.g. see Short 1983, a revision of *Angianthus* Wendl. s. lat.) and very often new genera should be recognized. This is also true for *Gnephosis* Cass. s. lat. Although not finalized my studies suggest that the c. 22 species will be ultimately dispersed among as many as nine different genera. *Trichanthodium* Sond. & F. Muell. ex Sond. is one such genus. It is readily distinguished from all other species in *Gnephosis* s. lat. by the fruit, which are covered by myxogenic cells. An absence of capitulum-subtending bracts and the capitular bract morphology are also features which provide a unique combination of characters by which the genus can be delimited from all others. The reinstatement of *Trichanthodium* is also supported by the results obtained from studies of mycorrhizal associations (Warcup 1990), and to a lesser extent by investigations of the chemical composition (Jakupovic *et al.* 1988) of species of *Gnephosis* s. lat.

At the time Bentham (1867) reduced *Trichanthodium* to synonymy under *Gnephosis* only the single species, *T. skirrophorum* was known. In subsequent years Fitzgerald (1905) described *G. exilis*, and Ewart & White (1909) described *G. baracchiana*. Neither Fitzgerald or Ewart & White commented about the delimitation of the genus although both noted an affinity with *G. skirrophora*. Since their work a further species with affinities with *T. skirrophorum* has been gathered and it (*T. scarlettianum*) is described here.

Evolution within *Trichanthodium* is particularly intriguing and partly for this reason a revision of the genus is presented here, rather than as a part of a larger paper on *Gnephosis* s. lat.

MATERIALS AND METHODS

Descriptions of taxa were made from dried collections and from specimens stored in 70% ethanol. Shapes were defined using the terms given by the Systematics Association Committee for Descriptive Terminology (1962).

Specimens were examined from the following herbaria: AD, BRI, CANB, CBG, K, MEL, NSW, NT, PERTH, UWA and KP (Kings Park, Western Australia).

The methods used to determine pollen-ovule ratios (P/Os) and anther dimensions have been previously outlined (Short 1985).

Fruit sections of *T. baracchianum* and *T. exilis* were obtained following the methods outlined in Short *et al.* (1989).

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

Cytological material was obtained from either floral buds fixed in the field or from root tips obtained from freshly germinated seed. Bud material was fixed in a solution of 4 parts chloroform, 3 parts absolute ethanol and 1 part glacial acetic acid. Root tips were pretreated in a 0.002 M solution of 8-hydroxyquinoline for two hours.

TAXONOMY

Trichanthodium Sond. & F. Muell. ex Sond., *Linnaea* 25: 489 (1853). TYPE: *Trichanthodium skirrophorum* Sond. & F. Muell. ex Sond.

[*Gnephosis aucti non* Cass.: Benth., *Fl. Austral.* 3:569 (1867) *p.p.*; Benth. in Benth. & Hook.f., *Genera Pl.* 2:320 (1873) *p.p.*; Hoffman in Engler & Prantl, *Naturl. Pflanzenfam.* IV(5):194 (1890) *p.p.*; J. M. Black, *Fl. S. Aust.* 1st ed. 646 (1926), 2nd ed. 926 (1957) *p.p.*; J. H. Willis, *Handb. Pl. Vict.* 2:730 (1973); Grieve & Blackall, *W. Aust. Wildfls* 817 (1975) *p.p.*; Short in Jessop, *Fl. Central Aust.* 389 (1981) *p.p.*; Short in Jessop & Toelken, *Fl. S. Aust.* 1519 (1986) *p.p.*]

Annual herbs. Major axes ascending to erect; stem simple or forming major branches at basal and/or upper nodes; major axes often developing minor shoots; all axes glabrous or lanate to tomentose. *Leaves* mainly alternate but the lowermost pair opposite, all leaves sessile, entire, \pm narrowly oblong to linear, ovate to lanceolate or narrowly elliptic, glabrous or lanate to tomentose, usually slightly mucronate but the uppermost ones with a hyaline apex. *Inflorescence* a compound head, depressed to broadly depressed ovoid, spheroid or obloid; general involucre usually *c.* 1/3–1/2 the length of the compound head and inconspicuous in the mature head but sometimes with leafy bracts *c.* the length of the head; the outer bracts leaf-like, the inner ones mainly hyaline and resembling the capitular bracts. *General receptacle* flat to convex, glabrous or with long bristles. *Capitula* 8– *c.* 250 per compound head. *Capitular bracts* 4–7, in 1 or 2 whorls, flat to conduplicate, primarily hyaline and yellow in the upper part but at least those of the outer row with a distinct, opaque midrib; outermost bracts densely hairy at the apex of the midrib with the bracts united by the tangled hairs; innermost bract(s) glabrous or sparsely hairy at the apex of a usually indistinct midrib. *Florets* 1 per capitulum; corolla tubular, 5-lobed, yellow. *Style* branches truncate, with short sweeping hairs. *Stamens* 5; anthers caudate, with a sterile, apical appendage; filament collar straight in outline, of uniform cells and basally not thicker than the filament. *Cypselas* homomorphic, obovoid, often somewhat flattened, brown; pericarp with myxogenic cells covering the surface, vascular bundles two; testa containing crystals; carpodium annular. *Pappus* an entire, truncate cup or a lacinate ring or cup.

Chromosome number: $n = 3, 4, 7$.

DISTRIBUTION (Fig. 1):

The genus is confined to central and southern mainland Australia. *T. skirrophorum* occurs across much of the continent, whereas the other species have comparatively restricted distributions and occur on the western and eastern ends of the distributional range of *T. skirrophorum*. *T. baracchianum* occurs on the margins of salt lakes in western Victoria, and *T. exilis* (also commonly found on the margin of saline lakes) and *T. scarlettianum* are found in Western Australia.

ECOLOGY:

Notes on habitat are provided under each species. All usually occur in semi-arid or arid areas and habitat data suggests tolerance of fairly high levels of salinity in all species.

All four have a dual mycorrhizal system, *i.e.* they form both ectomycorrhizal and vesicular-arbuscular mycorrhizal associations (Warcup 1990).

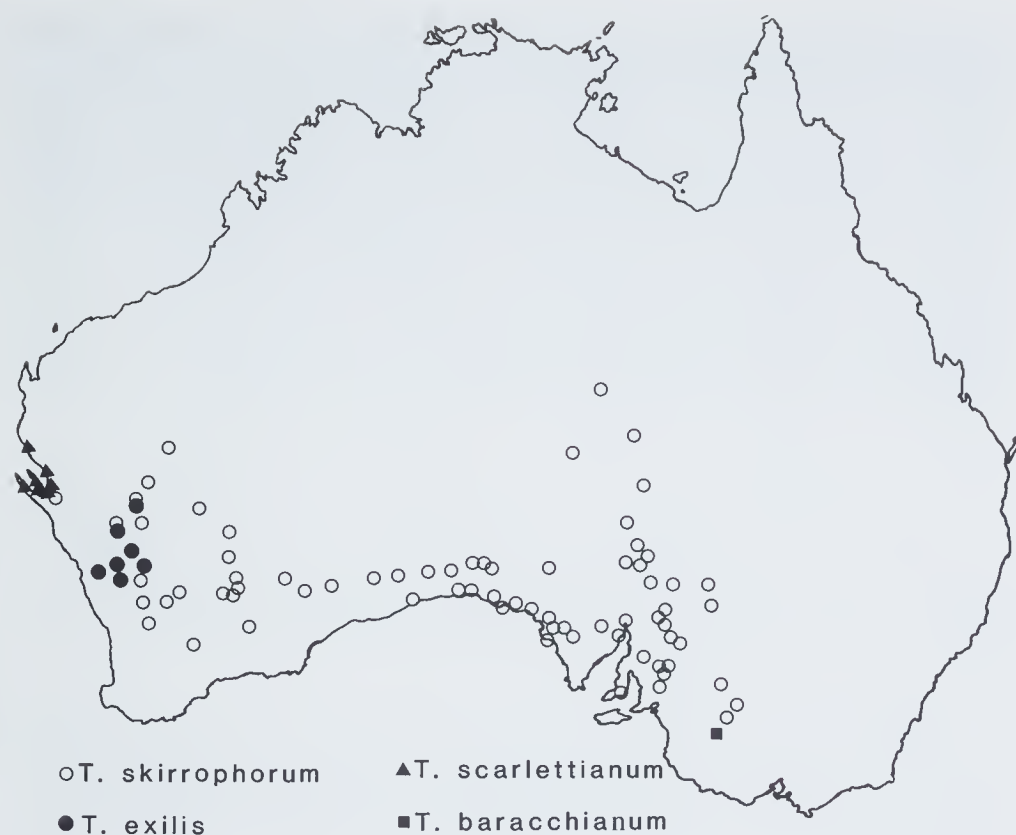


Fig. 1. Distribution of species of *Trichanthodium*.

CHEMISTRY:

Jakupovic *et al.* (1988) examined the chemistry of three species of *Gnephosis* s. lat., i.e. *G. arachnoidea*, *G. brevifolia* and *G. exilis* (= *T. exilis*). The latter showed no characteristic compounds whereas the chemistry of the two other species was found to be relatively uniform, with both producing sesquiterpene lactones. The data support the recognition of *Trichanthodium*.

BREEDING SYSTEMS:

As in previous works (e.g. Short 1981, 1986) pollen:ovule ratios (P/Os) have been used to help ascertain any differences in breeding system that may exist between species. The results (Table I) suggest that cross-pollination is common in all species but less common in *T. baracchianum*, this species having a much lower average P/O than the others. The reduction in pollen production is reflected in smaller anther size and the smaller, barely protruding anther appendages are also indicative of a greater degree of inbreeding in this species.

CYTOLOGY:

Chromosome number determinations for members of this genus are summarized in Table II. I do not doubt the accuracy of the determinations for *T. baracchianum* ($n = 3$), *T. exilis* ($n = 3$) and *T. skirrophorum* ($n = 4$) but determinations of both $n = 3$ and $n = 7$ for *T. scarlettianum* are perhaps open to question. On the other hand both Turner's voucher specimen and Short 2097 certainly belong to this species and it may be that, as with *Pogonolepis* (Short 1986), the morphological species concept does not equate well with biological species.

Table I. Pollen:ovule ratios (P/Os), anther characteristics, and chromosome numbers in species of *Trichanthodium*. Minimum, maximum and average values are shown where applicable.

Species	P/O	Total anther length (mm)	Length of microsporangia (mm)	Length of terminal anther appendage (mm)	Chromosome number (<i>n</i>)
<i>T. baracchianum</i>	404-1526 (891)	0.51-0.78 (0.65)	0.35-0.57 (0.46)	0.15-0.23 (0.18)	3
<i>T. exilis</i>	3504-6550 (5135)	0.99-1.18 (1.06)	0.71-0.92 (0.79)	0.24-0.33 (0.27)	3
<i>T. scarlettianum</i>	5213-7304 (6195)	1.19-1.42 (1.34)	0.86-1.13 (1)	0.3-0.38 (0.33)	3, 7
<i>T. skirrophorum</i>	1171-5584 (3728)	0.92-1.07 (0.96)	0.63-0.81 (0.68)	0.24-0.32 (0.27)	4

Accessory chromosomes have been observed in root tips of *T. exilis*. In one collection (Short 747) of *T. skirrophorum* it was noted that at metaphase I three bivalents and two univalents, not four bivalents, were formed although subsequent division is apparently normal (Figs 2a, b).

EVOLUTION:

All species exhibit a similar habit and can be difficult to identify without recourse to a magnifying aid. *T. skirrophorum* is the most readily distinguishable, being the only species having a general receptacle enveloped with bristles. Although they occur on opposite sides of the continent *T. baracchianum* and *T. exilis* are morphologically very similar and if the provenance of a collection is unknown they can only be reliably identified by the differences that relate to the plants' breeding system, *i.e.* anther size, the degree of protrusion of the anther appendages from the corolla tube, and pollen grain number. As previously noted (Short 1981) a considerable number of outbreeding/inbreeding species pairs exist within Australian inuloid genera and there seems no doubt that a greater degree of inbreeding, as found in *T. baracchianum*, is the derived condition.

Cytological evolution in Australian inuloid genera has previously been discussed by Turner (1970) and Merxmüller *et al.* (1977). For his discussion Turner (1970) accepted both Bentham's (1867) circumscription of the subtribe Angianthinae and its constituent genera. His two counts for *Gnephosis skirrophora* ($n = 4$) and the 'closely related *G. gynotricha* ($n = 12$)' (Turner 1970, p. 387) suggested to him that the latter is a hexaploid on a base of $x = 4$. He further suggested that an apparent absence of genera with $x = 5, 6$ or 9 suggested that $x = 4$ was the ancestral base for this subtribe. Taxa with $n = 7, 10, 11, 12$ and 13 were considered to be aneuploid derivatives from polyploids. However, *Gnephosis gynotricha* must be excluded from both *Gnephosis* and *Trichanthodium*, and the subtribe Angianthinae is clearly an artificial assemblage of genera (Short 1983).

Following Merxmüller *et al.* (1977) the Angianthinae are now included in the Gnaphalliinae. These authors noted that the base number for non-Australian Gnaphalliinae was almost exclusively $x = 7$. They further speculated that within Australia the series of $n = 21, 20, 19, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4$, and 3 could be interpreted as a descending series from $21, 14$ and 7 . Such a hypothesis seems reasonable as aneuploidy is correlated with annual habit in many plant groups and is the habit of the majority of Australian gnaphalioid species for which chromosome data are available.

A base of $x = 7$ is an *ancestral* base number for the entire Gnaphalliinae. Genera which appear to have lower base numbers than $x = 7$ could be expected to exist for long-established groups of annual species which have evolved in comparatively

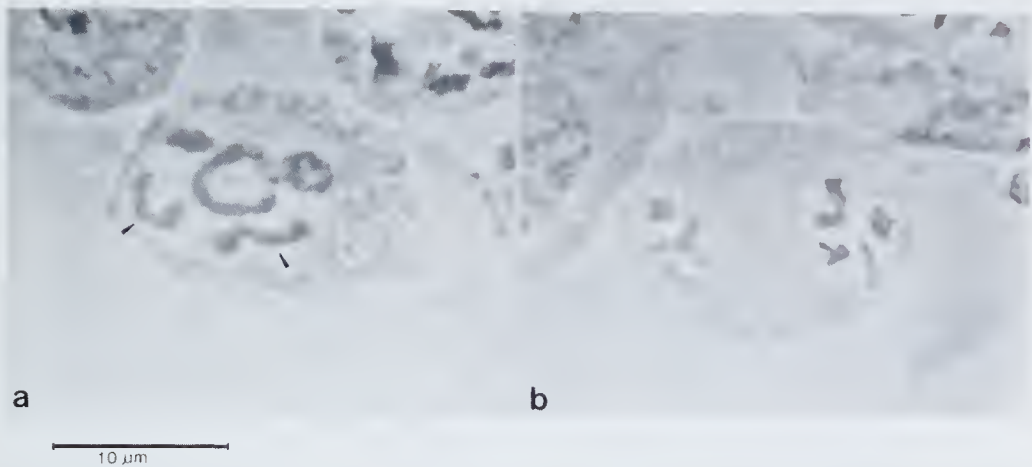


Fig. 2. Chromosomes in *T. skirrophorum* (Short 747), $n = 4$. a—Metaphase I with 3 II and 2 I. b—Anaphase I.

Table II. Chromosome number determinations in *Trichanthodium*

Species & locality	n	$2n$
<i>T. baracchianum</i>		
6.5 km SSE of Gerang Gerung, Vict. 3.xi.1984, <i>Scarlett 84/528</i>		6
Antwerp, Vict. 30.ix.1986, <i>Forbes 3152 & Albrecht</i>		6
<i>T. exilis</i>		
Mongers Lake, W.A. 18.ix.1977 <i>Short 563</i>		6 + 2 Bs
Lake Austin, W.A. 14.ix.1986 <i>Short 2922</i>	3	
<i>T. scarlettianum</i>		
100 miles S of Carnarvon, W.A. (<i>Turner 5420</i> —Turner 1970, as ' <i>Calocephalus skirrhophora</i> ') 40 km W of Overlander Roadhouse, W.A. 16.x.1983, <i>Short 2097</i>	7	6
<i>T. skirrophorum</i>		
c. 20 km SE of Ceduna, S.A. <i>Haegi 2688 & Short</i>	4	
3.3 km S of Copley, S.A. <i>Short 747</i>	4	
	(M1 with 311 & 21)	
1 km NE of Bulla Bulling, W.A. 18.ix.1982, <i>Short 1757</i>	4	
8 km S of Billabong Roadhouse, W.A. 11.ix.1986, <i>Short 2834</i>	4	
4 miles S of Norseman, W.A. (Turner 1970)	4	
34 miles W of Eucla, W.A. (Turner 1970)	4	

arid conditions. Such a scenario seems applicable for many Australian inuloid genera. Evidence suggests that *Pogonolepis* is a genus with a base of $x = 6$ (Short 1986) and it seems reasonable to suggest that *Trichanthodium* has a base of $x = 4$, with $n = 3$ the result of aneuploid reduction while $n = 7$ is either of hybrid origin or a reduction from $n = 8$, the tetraploid condition. Aneuploid reduction from $x = 7$ is certainly an alternative hypothesis but it is not supported by the absence of taxa with $n = 5$ or 6.

Considering the close morphological relationship of the species, the peripheral

occurrences of three of them at the eastern and western range extremes of the wide-ranging *T. skirrophorum*, the apparently derived breeding system in *T. baracchianum*, and the chromosomal data, it seems likely that *T. baracchianum*, *T. exilis* and perhaps *T. scarlettianum* have evolved from *T. skirrophorum*, or at least an ancestral entity with similar attributes. For students interested in plant speciation this would be an ideal group for detailed karyotype analysis and complementary electrophoretic studies of isozymes.

KEY TO THE SPECIES OF TRICHANTHODIUM

1. General receptacle with bristles 1. *T. skirrophorum*
1. General receptacle glabrous 2
2. Leaves tomentose; pappus a truncate cup 2. *T. scarlettianum*
2. Leaves glabrous to lanate; pappus a laciniate ring or cup 3
3. Anthers 0.9–1.2 mm long, apical appendage protruding from corolla tube (Western Australia) 3. *T. exilis*
3. Anthers 0.5–0.8 mm long, apical appendage not obviously protruding from corolla tube (Victoria) 4. *T. baracchianum*

1. ***Trichanthodium skirrophorum*** Sond. & F. Muell. ex Sond., Linnaea 25:489 (1853).—*Gnephosis skirrophora* (Sond. & F. Muell. ex Sond.) Benth., Fl. Austral. 3:570 (1867); J. M. Black, Fl. S. Aust. 1st ed. 646 (1929), 2nd ed. 926 (1957); J. H. Willis, Handb. Pl. Vict. 2:731 (1973); Grieve & Blackall, W. Aust. Wildfls 817 (1975); Short in Jessop, Fl. Central Aust. 390 (1981); Short in Jessop & Toelken, Fl. S. Aust. 3:1521 (1986). TYPE: 'Cudnaka'. LECTOTYPE (here chosen): *Mueller s.n.*, Cudnaka, N. Holl. austr., *s. dat.* (MEL 542193, ex herb. Sond.). ISOLECTOTYPE: *Mueller s.n.*, On arid hills and in the plains towards Cudnaka, -x.1851 (MEL 542194, K). See note 1.

Angianthus codonopappus F. Muell., Fragm. 9:2 (1875).—*Gnephosis codonopappa* F. Muell., in Giles, Geog. travels in Cent. Aust., 217 (1875), *nomen nudum*; F. Muell., Fragm. 9:2 (1875), *pro syn.*; Tate, Handbk Fl. extratrop. S. Aust. 128 (1890). TYPE: 'In vicinia lacus Eyrei; Giles.' LECTOTYPE (here chosen): *Giles s.n.*, Towards Lake Eyre, 1872 (MEL 542191). See note 2.

Annual herb, major axes 3–35 cm long, densely lanate. *Leaves* lanceolate or linear, 5.5–25 (33) mm long, 0.5–1.2 mm wide, tomentose, grey-green. *Capitula* 25–200 (c. 250) per compound head. *Compound heads* broadly depressed ovoid to obloid, 4–12 mm long, 4.5–17 mm diam.; general involucre c. 1/4–1/3 the length of the head, inconspicuous in the mature heads, consisting of a few outer leaf-like bracts and numerous inner hyaline bracts which grade into the capitular bracts; general receptacle transversely ellipsoid, with long bristles. *Capitular bracts* 5–6, arranged in ± 2 whorls; bracts of the outer whorl 3–4, flat to conduplicate, narrowly elliptic or narrowly oblong, primarily hyaline but with an opaque midrib extending c. 2/3–3/4 the length of the bract, densely hairy at the apex of the midrib; inner 1–2 bracts conduplicate, elliptic, midrib indistinct, extending to c. 2/3 the length of the bract, glabrous or with a few hairs in the upper part. *Florets* 1 per capitulum; corolla tube (1.35)1.7–2.6 mm long. *Anthers* 0.92–1.07 mm long; microsporangia 0.63–0.81 mm long; terminal anther appendage 0.24–0.32 mm long. *Pollen grains* c. 1,200–5,100 per floret. *Cypselas* 1.05–1.35 mm long, 0.55–0.6 mm diam. *Pappus* cup-like, 0.6–1.2 mm long.

Chromosome number: $n = 4$.

DISTRIBUTION (Fig. 1):

Widespread in central and southern mainland Australia, south of c. 24° S and west of c. 143° E.

ECOLOGY:

T. skirrophorum grows in an array of semi-arid or arid environments, often being found in somewhat saline soils. Collector's notes include: 'in gravelly saline sand, break-away area above salt-pan', 'Gypsum. Common in low samphire shrubland', 'Clay loam in *Atriplex*, *Nitraria* community', 'In pale brown loam, with scattered mulga, *Heterodendrum*, etc.' and 'Sandy loam with surface gibber. Between shrubs of *Acacia* and *Atriplex*.'

NOTES:

1. The lectotype sheet of *T. skirrophorum* (MEL 542193) contains several specimens, has the original label in Mueller's hand, and description in Sonder's hand. It probably could be regarded as the holotype but it is possible that the specimen MEL 542194 was seen, though not annotated, by Sonder. The other isolectotype sheet was examined when I visited K in 1985 and a detailed comparison of this sheet and the lectotype specimen has not been made.

2. The sheet MEL 542191 contains a single specimen, plus fragments in an accompanying envelope, of *Angianthus codonopappus*. In the absence of other specimens it could be argued that the sheet could be regarded as the holotype specimen but an additional label records 'Type . . . 1 of our only 3 specimens'. Other syntype material has not been located but, as it may exist, MEL 542191 is selected as the lectotype specimen.

SELECTED SPECIMENS EXAMINED (Total c. 150):

Western Australia—35 km SW of Kalgoorlie, 29.ix.1965, *Donner s.n.* (AD 96713238); 128 miles N of Rawlinna, 12.x.1966, *George 8468* (PERTH); c. 76 km N of Bullfinch, 4.xi.1983, *Haegi 2512 & Short* (AD, MEL, PERTH); 8 km S of Billabong Roadhouse, 11.ix.1986, *Short 2834* (AD, MEL, PERTH); c. 3 km from Yalgoo along Paynes Find road, 14.ix.1986, *Short 2908* (MEL, PERTH).

Northern Territory—NW Simpson Desert, 29.ix.1973, *Latz 4394* (AD, NT).

South Australia—6.5 km NE of Chilpuddie, 15.x.1967, *Eichler 19549* (AD); 15 km W of Leigh Creek, 12.x.1958, *Schodde 975* (AD); 10 km W of Blanchetown, 2.xi.1971, *Whibley 3755* (AD).

Queensland—Poeyppel Corner, 24.ix.1966, *Boylard 236A* (BRI, MEL, NSW).

New South Wales—48 km NE of Broken Hill, 16.x.1921, *Ising s.n.* (AD 96935543).

Victoria—24 km NW of Underbool, 20.x.1983, *Browne 176* (MEL); 45 km SSW of Mildura, 13.x.1977, *Crisp 3431* (CBG, MEL).

2. *Trichanthodium scarlettianum* P. S. Short, *sp. nov.*

Herba annua, axibus maioribus c. 3–25 cm longis, lanatis. *Folia* linearia vel lanceolata, c. 5–30 cm longa, 0.5–1.1 mm lata, tomentosa, ravida. *Glomeruli* depresso late usque depresso ovoidei, 4.5–6 mm longi, 5–11 mm diametro; bractae glomerulos subtendentes longitudine c. 1/3–1/2 glomeruli; receptaculum convexum glabrum. *Capitula* 14–130. *Bractae intra capitulum* 4–5, 2.1–3.3 mm longae, uno-vel biseritae; bractae exteriorae 4, conduplicatae, praecipue hyalinae sed costis opacis ad apicem dense pilosis; bractea interiorae plerumque praesens, elliptica vel oblanceolata, glabra vel costa ad apicem sparsim pilosa. *Flosculus* in quoque capitulo 1; corolla 5-lobata, tubo 1.7–2.4 mm longos. *Stamina* 5; antherae 1.19–1.42 mm longae, sporangiis 0.86–1.13 mm longis. appendicibus terminalibus 0.3–0.38 mm longis. *Cypselae* 1–1.8 mm longae, 0.6–0.9 mm diametro. *Pappus* cyathiformis, 0.5–1.15 mm longus, laceratus, albus.

HOLOTYPE: Western Australia, Goulet Bluff, Peron Peninsula. 26° 13'S, 113° 41'E. Calcareous sand amongst samphire and *Frankenia*. 17.x.1983, *Short 2106* (MEL 1523476). **ISOTYPE:** AD, CANB, PERTH.

Annual herb, major axes c. 3–25 cm long, lanate. *Leaves* linear or lanceolate, c. 5–30 mm long, 0.5–1.1 mm wide, tomentose, grey-green. *Compound heads* depressed to broadly depressed ovoid, 4.5–6 mm long, 5–11 mm diam.; general involucre c. 1/3–1/2 the length of the head, inconspicuous in the mature heads; general receptacle convex, glabrous. *Capitula* 14–130 per compound head. *Capitular bracts* 4–5, 2.1–3.3 mm long, arranged in 1 or 2 whorls; outer bracts 4, conduplicate, mainly hyaline but with an opaque midrib extending c. 2/3–3/4 the length of the bract, densely hairy at the apex of the midrib; an inner bract usually present, elliptic or oblanceolate, glabrous or with a few hairs at the apex of the midrib. *Florets* 1 per capitulum; corolla tube 1.7–2.4 mm long. *Anthers* 1.19–1.42 mm long;

microsporangia 0.86–1.13 mm long; terminal anther appendages 0.3–0.38 mm long. Pollen grains c. 5,100–7,300 per floret. Cypselas 1–1.8 mm long, 0.6–0.9 mm diam. Pappus a white, slightly jagged cup 0.5–1.15 mm long. (Fig. 3)

Chromosome number: $n = 3, 7$.

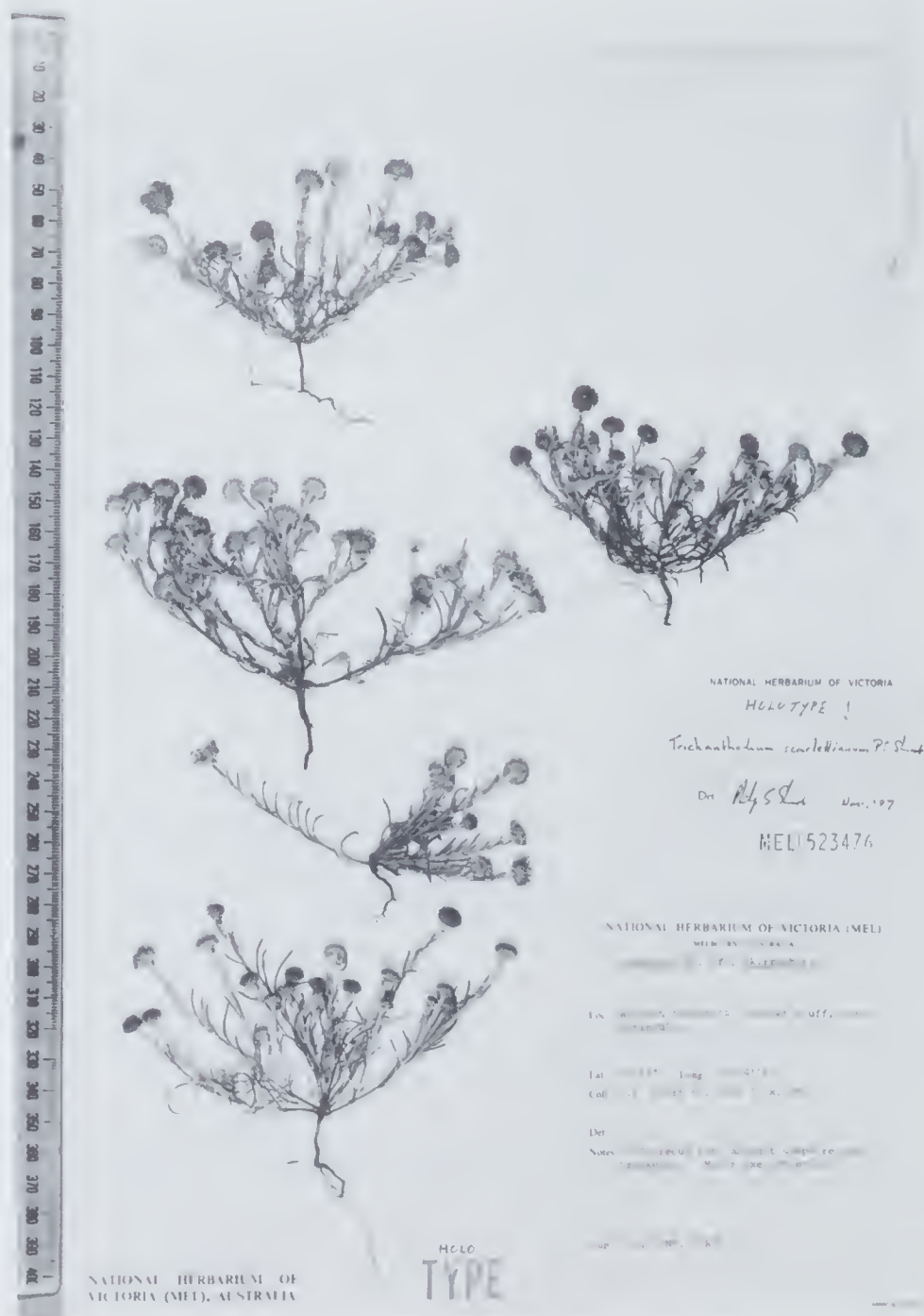


Fig. 3. Holotype sheet of *T. scarlettianum* (Short 2106).

DISTRIBUTION (Fig. 1):

Restricted to the Shark Bay region of Western Australia between latitudes c. 25° and 27° S and west of longitude 115° E.

ECOLOGY:

Occurs on coastal and inland arid regions, growing in sandy to clay soil and a variety of plant communities. The association of the species with samphires and *Frankenia*, as noted for the type collection, plus its occurrence on foredunes, is indicative of a tolerance to salinity. Collector's notes include: 'Acacia, chenopod steppe. Heavy calcareous clay', 'Limestone rock interspersed with red sand. *Acacia* sp. & *Ptilotus obovatus* association', 'in loam in *Acacia* scrub', 'Low chenopod (mainly *Atriplex*) shrubland. Sandy loam' and 'Beach foredunes with *Angianthus tomentosus* & *Gnephosis tenuissima*'.

NOTES:

1. The specific epithet honours Neville Scarlett of Latrobe University. He recollected *T. baracchiana* in 1983, the first specimens to be gathered since 1910.

SELECTED SPECIMENS EXAMINED (Total c. 20):

Western Australia—Dirk Hartog Is., 2.ix.1972, *George 11381* (CANB, PERTH); 7 km S of Overlander Roadhouse, 20.viii.1977, *Short 420* (AD); 43 km N of Overlander Roadhouse, 21.viii.1977, *Short 443* (AD); 28 km S of Wooramel River along the North West Coastal Highway, 16.x.1983, *Short 2092* (MEL).

3. *Trichanthodium exilis* (W. V. Fitzg.) P. S. Short, *comb. nov.*

BASIONYM: *Gnephosis exilis* W. V. Fitzg., J. W. Aust. Nat. Hist. Soc. 2:24 (1905); Grieve & Blackall, W. Aust. Wildfls 817 (1975). TYPE: 'Minginew, September, 1903.—W.V.F.' LECTOTYPE: Western Australia, Minginew, -ix.1903, *Fitzgerald s.n.* (NSW 138835).

Annual herb, the major axes 2–20 cm long, ± glabrous or lanate. *Leaves* ± narrowly oblong to linear or ± oblanceolate, c. 4–11 mm long, 0.7–1.3 mm wide, sometimes semisucculent, glabrous or lanate, usually green or grey-green but sometimes purple. *Compound heads* broadly depressed to depressed ovoid, spheroid or obloid, 4–11 mm long, 4.5–11 mm diam.; general involucre c. 1/3–1/2 the length of the compound head, inconspicuous in the mature heads; general receptacle ± flat to convex, glabrous. *Capitula* c. 10–200 per compound head. *Capitular bracts* 5–6, ± flat and narrowly elliptic or narrowly obtrullate, or conduplicate, 2.1–2.8 mm long, primarily hyaline but with an opaque midrib extending c. 2/3–3/4 the length of the bracts, arranged in ± 2 whorls; outer bracts densely hairy at the apex of the midrib; innermost bracts generally resembling the outer ones but less hairy. *Florets* 1 per capitulum; corolla tube 1.1–1.6 mm long. *Anthers* 0.99–1.18 mm long; microsporangia 0.71–0.92 mm long; terminal anther appendages 0.24–0.33 mm long. *Pollen grains* c. 3,500–6,550 per floret. *Cypselas* 0.9–1.6 mm long, 0.4–0.8 mm diam. *Pappus* a jagged ring, c. 0.2–0.65 mm long.

Chromosome number: $n = 3$.

DISTRIBUTION (Fig. 1):

Restricted to Western Australia between latitudes c. 27° and 30° S and longitudes c. 115° 30' and 118° E. Particularly common on the Monger Lake System (in which Lake Moore is included, see Beard 1973) but extending to salt lakes on the southern margins of the Murchison Drainage Division (Bettenay & Mulcahy 1972, Mulcahy & Bettenay 1972).

ECOLOGY:

The species is commonly found on the margins of saline depressions, suggesting a high tolerance to salinity, but some collections suggest that it is not completely

confined to saline soils, with specimens occurring in red sandy soil well above the saline margins of salt lakes. Collector's notes include: 'Sandy loam on outer edge of *Halosarcia* zone in salty depression', 'Samphire flat. Gypseous clay', 'Powdery clay loam with *Halosarcia*', 'Low chenopod shrubland on saline flat', 'Clayloam. With scattered shrubs of *Lawrencia* and *Atriplex*' and 'c. 200 m inland from salt lake. Red sandy soil'.

NOTES:

1. The only type collection known to me is NSW 138835. It is annotated 'Type' in what appears to be Fitzgerald's hand. As further syntype specimens may exist the NSW specimen has been designated the lectotype.

2. Near Yalgoo both *T. exilis* and *T. skirrophora* (Short 2907 & Short 2908 respectively) have been observed growing in a low lying area dominated by *Atriplex*. Both species were represented by hundreds of individual plants and it was evident that *T. exilis* tended to favour the more shallow, possibly more saline depressions. A narrow zone of overlap existed between the species but probable hybrids were not detected.

3. The pappus in *T. exilis* varies in size, from c. 0.2 mm to 0.7 mm long, and the extent to which it is divided into segments. The type collection displays a large, highly lacinate cup-like pappus. Other collections have a smaller pappus but, in some collections (e.g. Wilson 12294), some specimens have the smaller, less divided pappus ring, others have the larger, lacinate pappus. To some extent the variation is correlated with floret maturity, with the pappus becoming more lacinate as the florets mature.

SELECTED SPECIMENS EXAMINED (Total c. 15):

Western Australia—c. 7.3 km S of Bunjil, 18.ix.1977, Short 584 (AD); c. 3 km from Yalgoo along road to Paynes Find, 1.ix.1982, Short 1609 (AD, BRI, CANB, DNA, MEL, PERTH); c. 31 km S of Cue (Lake Austin), 14.ix.1986, Short 2922 (AD, CANB, MEL, NSW, PERTH); 6 km S of Warriedar HS near bank of Mongers Lake, 26.ix.1986, Wilson 12294 (MEL, PERTH).

4. *Trichanthodium baracchianum* (Ewart & J. White) P. S. Short, *comb. nov.*

BASIONYM: *Gnephosis baracchiana* Ewart & J. White, Proc. Roy. Soc. Vict. 21:542, pl. 30, figs 3–8 (1909); J. H. Willis, Handb. Pl. Vict. 2:731 (1973); Leigh *et al.*, Extinct & Endangered Pl. Aust. p. 157 (1984). TYPE: 'Salt swamp near Mission Station, Dimboola, St. Eloy D'Alton. LECTOTYPE (here chosen): Salt swamp near Mission Station, Dimboola, s. dat., D'Alton s.n. (MEL 542236). PROBABLE ISOLECTOTYPE: Near Dimboola, -i.1902, D'Alton s.n. (NSW s.n.). POSSIBLE LECTOPARATYPE: Antwerp, s. dat., D'Alton s.n. (MEL 1520240); Neighbourhood of Mission Station, Antwerp, s. dat., D'Alton s.n. (MEL 85398); Jeparit, s. dat. D'Alton s.n. (MEL 85397). See note 1.

Annual herb, the major axes 1–10 cm long, glabrous to lanate. *Leaves* ± narrowly oblong to linear or ± narrowly elliptic, or ovate to lanceolate, 4.5–12 mm long, 0.5–2.2 mm wide, semisucculent, slightly mucronate, mainly glabrous but sometimes sparsely lanate. *Compound heads* depressed to broadly depressed ovoid, 4–7 mm long, 5–11 mm diam.; general involucre usually c. 1/2 the length of the compound head and inconspicuous in the mature head but sometimes with outer leafy bracts extending c. the length of the head; general receptacle ± convex, glabrous. *Capitula* 8–50 per compound head. *Capitular bracts* (4–)5(–7), ± flat, narrowly elliptic of oblanceolate, or conduplicate, 2.2–2.7 mm long, primarily hyaline but with an opaque midrib extending c. 2/3–3/4 the length of the bract, arranged in 2 whorls; outer bracts densely hairy at the apex of the midrib; inner bracts sparsely hairy at the apex of an indistinct midrib. *Florets* 1 per capitulum; corolla tube 1.1–1.2 mm long. *Anthers* 0.51–0.78 mm long; microsporangia 0.35–0.57 mm long; terminal anther appendages 0.15–0.23 mm long. *Pollen grains* c. 400–1,500 per floret. *Cypselas* 1.3–1.5 mm long, 0.85–1.1 mm diam. *Pappus* a jagged ring 0.3–0.4 mm high.

Chromosome number: $n = 3$.

DISTRIBUTION (Fig. 1):

Restricted to western Victoria in the Jeparit–Horsham district.

ECOLOGY:

Grows in saline flats. Collector's notes include: 'flats on the fringe of a salt lake . . . disturbed ground with *Sarcocornia*' and 'in the higher parts of samphire dominated by *Halosarcia pergranulata*, *H. pruinosa*. Gypseous soils'.

NOTES:

1. There are four sheets of *T. baracchianum* at MEL which could be regarded as syntypes. The sheet chosen as the lectotype is the only one with a label giving the locality as Dimboola. Furthermore, it is annotated as 'Type', possibly in Ewart's hand, and contains the specimen used to illustrate the habit of the species in the original publication. The two sheets deemed to come from Antwerp also have the word 'Type' pencilled on them. This seems to be in the hand of White, suggesting that both specimens were probably viewed by Ewart & White when compiling the original description. The undated collection from Jeparit (MEL 85397) may have been viewed by Ewart and White prior to publication. However a further collection gathered by D'Alton from Jeparit on 11 October 1910 is housed at K, suggesting that the MEL collection is not a syntype.

The probable isolectotype sheet at NSW has an original MEL label and the specimens match the lectotype. Only the presence of a date and the absence of mention of the mission station for the locality suggest that it may not be a duplicate of the lectotype.

2. The species was presumably named after Pietro Baracchi of the Melbourne Observatory and a member of the Royal Society of Victoria.

3. Leigh *et al.* (1984) reported this species to be rare and possibly extinct. This is not surprising as the few specimens known to them were probably collected no later than 1910. However, in 1983, Neville Scarlett (LTB) recollected the species from several sites and it is evident that, although restricted in its distribution, it is locally common. Most importantly it is known to occur in the Mitre Flora and Fauna Reserve (Beaglehole 86523).

SELECTED SPECIMENS EXAMINED (Total c. 14):

Victoria—Mitre Flora & Fauna Reserve, 11.xi.1986, Beaglehole 86523 (MEL); 3.5 km W of Antwerp, 26.x.1983, Scarlett 83/266 (MEL); 6 km SSW of Jeparit, 27.x.1983, Scarlett 83/275 (MEL).

ACKNOWLEDGEMENTS

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A REVISION OF THE GENUS *CHTHONOCEPHALUS* Steetz (ASTERACEAE: INULEAE: GNAPHALIINAE).

by

P. S. SHORT*

ABSTRACT

Short, P. S. A revision of the genus *Chthonocephalus* Steetz (Asteraceae: Inuleae: Gnaphaliinae). *Muelleria* 7(2): 225–238 (1990). The endemic Australian genus *Chthonocephalus* Steetz is revised. Six species are recognized, i.e. *C. pseudevax* Steetz and *C. tomentellus* (F. Muell.) Benth., and four new species, *C. spathulatus* P. S. Short, *C. oldfieldianus* P. S. Short, *C. muellerianus* P. S. Short and *C. viscosus* P. S. Short. *C. multiceps* J. H. Willis is excluded from the genus.

HISTORY & GENERIC DELIMITATION

The endemic Australian genus *Chthonocephalus* was first described by Steetz in 1845 in Lehmann's *Plantae Preissianae*. At the time only a single species, *C. pseudevax* Steetz, was recognized. A few years later Asa Gray (1851) described *C. drummondii*. Bentham (1867) subsequently reduced the latter to synonymy under *C. pseudevax*. He also reduced *Chamaesphaerion* A. Gray (June 1851), *Gyrostephium* Turcz. (Aug.–Oct. 1851; synonymous with the latter genus, both genera having been based on duplicate specimens of *Drummond* 55) and *Lachnothalamus* F. Muell. (1863) to synonymy under *Chthonocephalus*. Thus Bentham (1867) recognized three species: *C. pseudevax*, *C. pygmaeus* (A. Gray) Benth. and *C. tomentellus* (F. Muell.) Benth. He did not discuss the reasons for uniting the genera but one assumes from the key and from his treatment in Bentham & Hooker (1873) that he placed great emphasis on the presence of receptacular bracts or paleae. Of all other genera within the subtribe 'Angiantheae', only *Craspedia* Forst.f. was known to have such scales and members of it could be readily distinguished in the key. Thus *Craspedia* was distinguished by 'Pappus of several plumose-ciliate bristles or scales. Stems or peduncles elongated and erect' as opposed to 'Pappus none or of very short scales. Dwarf, diffuse or stemless annuals' for *Chthonocephalus* (Bentham 1867, p. 453).

There seems to have been no opposition to this treatment and a further species, *C. multiceps* J. H. Willis, was described in 1952. However, following a revision of *Angianthus* Wendl. s. lat., it was realized (Short 1983) that *C. pygmaeus* was referable to *Siloxerus* Labill., the species differing from *C. pseudevax* and *C. tomentellus* by virtue of its very different general receptacle, bract and fruit morphology. My studies have also shown that *C. multiceps* should be excluded from *Chthonocephalus* as it differs in features of the fruit and bracts. It is closely related to *Calocephalus aervoides* (F. Muell.) Benth. and both taxa should probably be referred to a separate genus. (The most distinctive feature pertains to the paleae which are confined to the centre of the receptacle and are partly fused at the base.) Thus of the species recognized by Bentham only two, *C. pseudevax* and *C. tomentellus*, are retained in the genus.

In this paper I attribute a further four species to the genus, i.e. *C. spathulatus*, *C. muellerianus*, *C. oldfieldianus* and *C. viscosus*.

All species have similar fruit and capitular bracts and these characters seem to separate them from other Australian compound-headed inuloid species. The brown, ovoid fruit has a thin pericarp and testa which lack a layer of collenchyma or sclerenchyma. Two vascular bundles occur in the pericarp and small myxogenic cells may be distributed over the surface. (Differences in the fruit anatomy do occur between species in that some lack a well-developed carpodium, and a crystalline layer does not seem to be well developed in the pericarp of all species—see Fig.

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

2.) The capitular bracts are in a single row and are usually predominantly green and opaque. (*C. viscosus* has bracts which are largely hyaline but there is a prominent midrib.) The presence of receptacular scales and the absence of a pappus also aid in the identification of the genus although a pappus of plumose bristles is found in *C. muellerianus* and paleae are absent in *C. viscosus*.

Within the genus several groups of species can be recognized. Thus *C. tomentellus* and *C. muellerianus* have a different habit to all other species, all plants having an obvious stem, and their fruit have an annular carpodium. In other species the stem is inconspicuous. In the *C. pseudevax* group (i.e. *C. spathulatus*, *C. oldfieldianus* and *C. pseudevax*) all species seem to have fruit which lack a distinct carpodium. (Only immature fruit of *C. oldfieldianus* have been examined but a carpodium appears to be absent.) At least in *C. pseudevax* and *C. spathulatus* the fruit are also polymorphic in regard to their size, with about 5% of the fruit from the same compound head being much larger than the rest. Fruit of other species show little variation in size. Before I was aware of *C. viscosus* I had considered recognising two sections or subgenera. However *C. viscosus* has the habit of members of the *C. pseudevax* group, and fruit as in *C. tomentellus* and *C. muellerianus*. This same species could be placed in its own infrageneric category by virtue of the lack of paleae, thus allowing the recognition of three subgenera or sections but I see little merit in this action.

TAXONOMY

Chthonocephalus Steetz in Lehm., Pl. Preiss. 1:444 (1845); Benth., Fl. Austr. 3:581 (1867) *p.p.*; Benth. in Benth. & J. Hook., Genera Pl. 2:186 (1873) *p.p.*; Hoffman in Engler & Prantl, Natürl. Pflanzem. IV(5):195 (1890) *p.p.* TYPE: *C. pseudevax* Steetz.

Lachnothalamus F. Muell., Fragm. 3:156 (1863). TYPE: *L. tomentellus* F. Muell. [= *C. tomentellus* (F. Muell.) Benth.]

[*Chamaesphaerion auct. non* A. Gray, Hook. J. Bot. Kew Gard. Misc. 3:176 (June 1851), as to *Chthonocephalus pygmaeus* (A. Gray) Benth. (= *Siloxerus pygmaeus*), see Short, Muelleria 5:204 (1983).]

[*Gyrostephium auct. non* Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2):76 (Oct. 1851), as to *Chthonocephalus pygmaeus* (A. Gray) Benth., see Short, Muelleria 5:204 (1983).]

Annual herbs consisting of a compound head surrounded by a flat, basal rosette of leaves or with a conspicuous stem and usually branching at basal and near basal nodes, the major axes prostrate to ascending, sometimes producing minor shoots. *Leaves* sessile, entire, in a basal rosette beneath the compound heads or alternate on the branches, vestiture eglandular, cobwebby or villous. *Compound heads* spheroid to lenticular or broadly depressed to depressed ovoid, rarely absent; bracts subtending the compound heads absent or of 1 or several rows of hyaline or leaf-like bracts; general receptacle disc-like, solid or shortly branched, the partial receptacles distributed evenly over its surface, glabrous or hairy. *Capitula* (2)5–50 per compound head; capitulum-subtending bracts absent. *Capitular bracts* c. 6, oblanceolate or spathulate, flat or distinctly curved, each with an opaque, green midrib, a hyaline apex and usually with narrow to broad hyaline margins, the margins with long hairs, midrib glabrous or with long hairs on the outer surface. *Paleae* usually present (absent in *C. viscosus*) subtending 1, rarely 2 florets, not resembling the capitular bracts, hyaline, lacking a midrib. *Partial receptacle* glabrous. *Florets* (2)5–40, tubular, bisexual, yellow; corolla 3–5-lobed. *Style* branches truncate, with short sweeping hairs. *Stamens* 3–5; *anthers* barely caudate, each with a sterile apical appendage; filament collar straight in outline and not thicker than the filament. *Cypselas* obovoid, brown, pericarp with two oblique or medial vascular bundles, a layer with crystals usually discernible in mature fruit, carpodium absent or well-developed.

DISTRIBUTION (Fig. 1):

All six species occur in Western Australia and five are restricted to that state. *C. pseudevax* extends across the southern part of the mainland. The Shark Bay region of Western Australia is the centre of diversity of the genus.

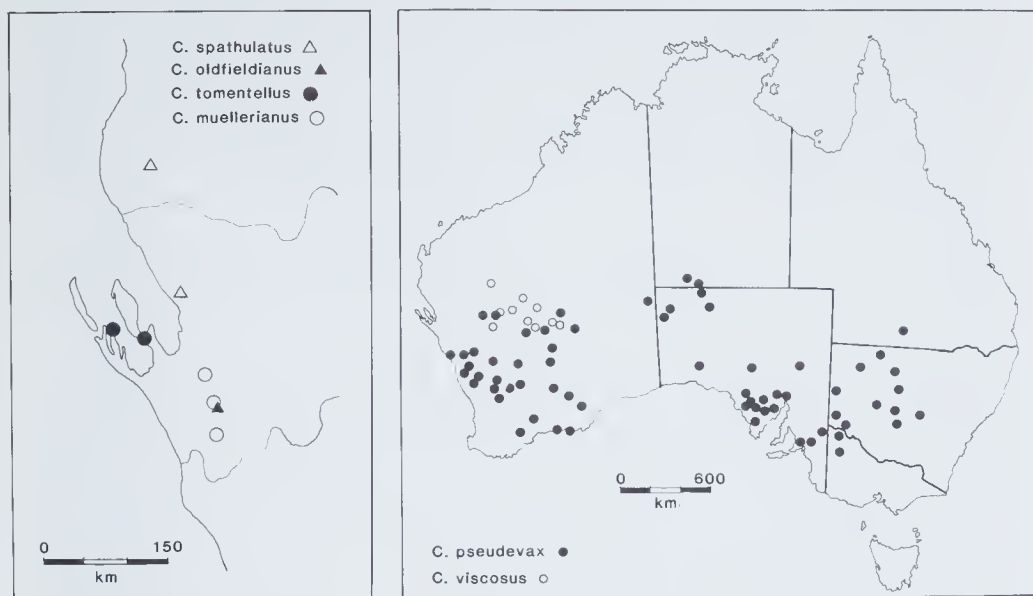


Fig. 1. Distribution of species of *Chthonocephalus*.

REPRODUCTIVE BIOLOGY:

The use of pollen:ovule ratios (P/Os) in the determination of plant breeding systems has been previously discussed (Short 1981). Within *Chthonocephalus* five of the six species, by virtue of P/Os of several thousand, can be regarded as out-breeders (*i.e.* cross-fertilization is common, if not obligatory) compared to *C. pseudevax* for which an average P/O of *c.* 150 has been determined. The inbreeding nature of the latter species is also reflected by its trimerous and tetramerous florets, instead of pentamerous florets which are found in all other species. As with many inbreeding/outbreeding species pairs *C. pseudevax* is a widespread species whereas its closest relative, *C. oldfieldianus*, is only known from a single population.

KEY TO SPECIES OF CHTHONOCEPHALUS

- | | |
|--|----------------------------|
| 1. Receptacular bracts absent | 6. <i>C. viscosus</i> |
| 1. Receptacular bracts present | 2 |
| 2. Plants seemingly stemless, consisting of a compound head surrounded by a basal rosette of leaves, if branching then with an apparently sessile compound head immediately above the root | 3 |
| 3. Plants branching, or if not branching then the compound head surrounded by <i>c.</i> 2-4 erect leaves | 1. <i>C. spathulatus</i> |
| 3. Plants with a reduced, seemingly absent stem; leaves surrounding compound heads not held erect | 4 |
| 4. Florets 5-lobed | 2. <i>C. oldfieldianus</i> |
| 4. Florets 3 or 4-lobed | 3. <i>C. pseudevax</i> |
| 2. Plants with all compound heads terminating major axes that are more than <i>c.</i> 1 cm long | 5 |
| 5. Pappus absent | 4. <i>C. tomentellus</i> |
| 5. Pappus of plumose bristles | 5. <i>C. muellerianus</i> |

1. *Chthonocephalus spatulatus* P. S. Short, *sp. nov.*

Herba annua, caule inconspicuo; quaeque planta glomerulus rosula foliorum erectorum, vel planta ramificans sed glomerulo proxime super radicem, axibus maioribus prostratis, usque c. 6 cm longis, arachnoideis. *Folia* erecta, oblanceolata vel spatulata, c. 0.5–5 cm longa, 0.1–0.7 cm lata, praecipue ad basem glomerulorum, tomentosa. *Glomeruli* plerumque transverse ellipsoidei usque lenticulares, raro depresso late ovoidei, c. 0.35–0.5 cm alti, c. 0.5–2 cm diametro; bracteae glomerulos subtendentes aliquot-seriatae, late ovatae vel late obovatae saepe ita irregulariter, c. 4–4.5 mm longae, c. 2.5–4 mm latae, hyalinae, marginibus parce longe ciliatis; receptaculum glabrum. *Capitula* c. 5–10; bracteae intra capitulum 5–6, 3.6–4.3 mm longae, c. 0.4–0.5 mm latae, marginibus et apice parce pilosis. *Paleae* obovatae, 3.4–3.6 mm longae, 1.2–1.7 mm latae, hyalinae, marginibus integris vel parce longe ciliatis, pagina exteri glabra vel pilosa. *Flosculi* (2)5–12; corolla 5-lobed, tubos 2.1–2.5 mm longos. *Stamina* 5; antherae 0.96–1 mm longae, sporangiis 0.71–0.78 mm longis, appendicibus terminalibus triangularibus, 0.18–0.29 mm longi. *Pollinis grana* in quaque anthera c. 500. *Cypselae* 0.5–0.95 mm longae, 0.3–0.6 mm diametro. *Pappus* carens.

HOLOTYPE: Western Australia, Boologooro Homestead. 24° 20'S, 114° 02'E. Red-brown loam. Open *Acacia* shrubland. 18.viii.1986, *Short 2484, Lander & Fuhrer* (MEL 1555156). ISOTYPE: AD, PERTH.

Annual herb consisting of a compound head (rarely a single capitulum) surrounded by c. 2–7 erect leaves, or branching at basal and near basal nodes, if branching then with a compound head immediately above the root, the major axes prostrate, to c. 6 cm long, cobwebby. *Leaves* erect (at least in freshly watered specimens), oblanceolate or spatulate, the lower part sometimes dilated, hyaline, c. 0.5–5 cm long, 0.1–0.7 cm wide, mainly restricted to the base of the compound heads, tomentose. *Compound heads* usually transversely elliptic to lenticular but broadly depressed ovoid in small plants, c. 0.35–0.6 cm high, c. 0.5–2 cm diam.; bracts subtending compound heads consisting of several rows of hyaline bracts, the bracts widely ovate or widely obovate but the shape often very irregular, c. 4–4.5 mm long, c. 2.5–4 mm wide, with sparsely long-ciliate margins; general receptacle disc-like, solid, glabrous. *Capitula* c. 5–70 per compound head; capitular bracts 5–6, in a single whorl and each bract consisting of an opaque, green midrib with a hyaline apex and narrow hyaline margins, the entire bracts 3.6–4.3 mm long, c. 0.4–0.5 mm wide and with a few hairs on the margins and near the apex. *Paleae* obovate, 3.4–3.6 mm long, 1.2–1.7 mm wide, midrib absent, margins entire or with a few long-ciliate hairs, outer surface glabrous or with long hairs. *Florets* (2)5–12 per capitulum; corolla 5-lobed, the tube 2.1–2.5 mm long. *Stamens* 5; anthers 0.96–1 mm long; microsporangia 0.71–0.78 mm long; apical appendage triangular, 0.18–0.29 mm long. *Pollen grains* c. 500 per anther. *Cypselas* obovoid, 0.5–0.95 mm long, 0.3–0.6 mm diam. *Pappus* absent. (Figs 2, 3)

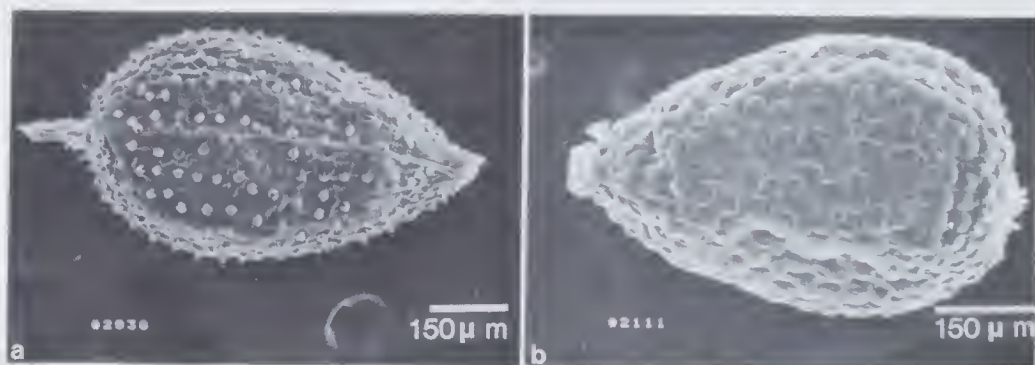


Fig. 2. Fruit of *Chthonocephalus*. a—*C. landeri* (Short 2038), b—*C. muellerianus* (Short 2111).

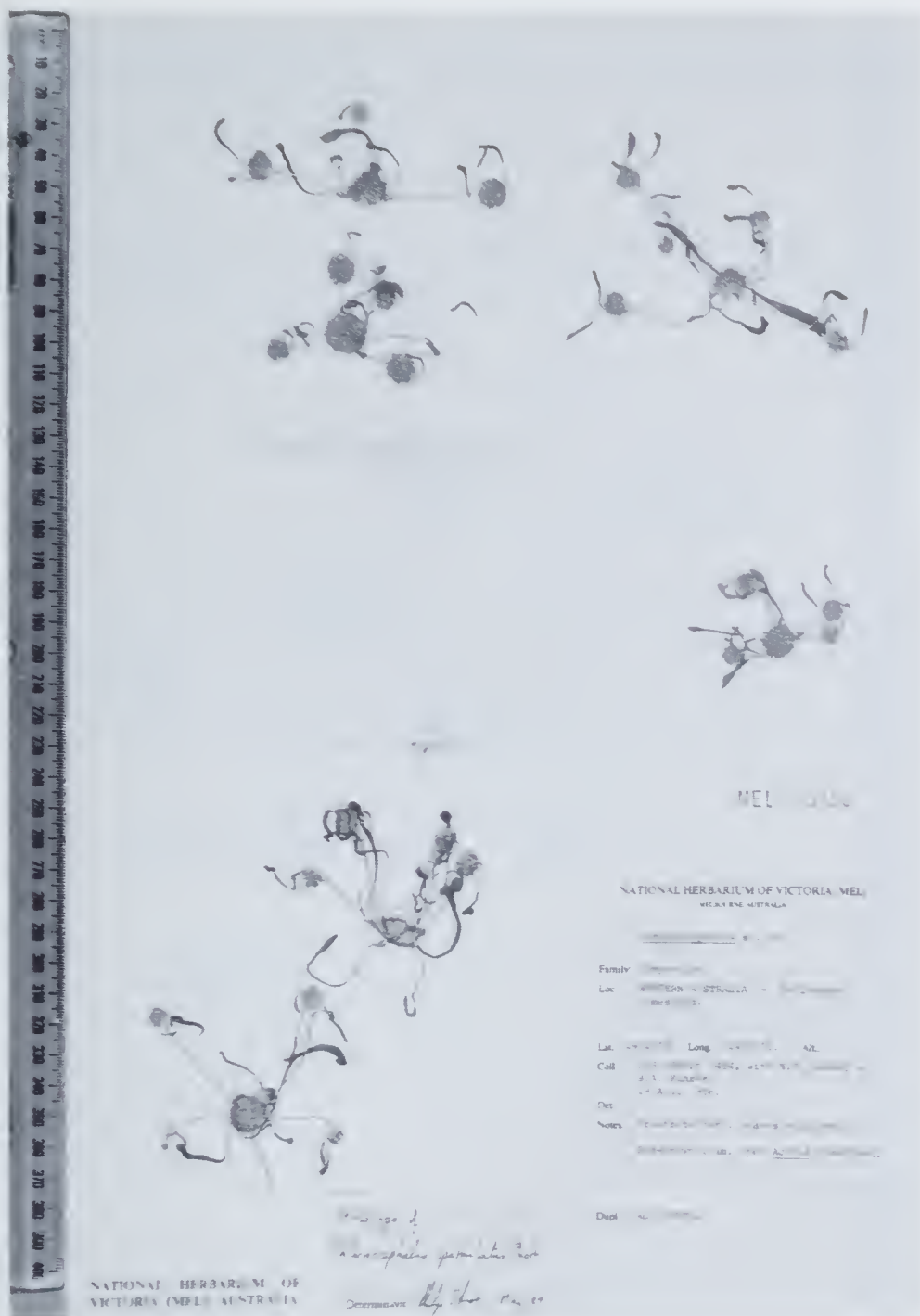


Fig. 3. Holotype sheet of *C. spathulatus* (Short 2484 et al.)

DISTRIBUTION (Fig. 1):

Restricted to the Carnarvon region of Western Australia. Of the five collections all but one have been collected in the vicinity of Booloogooro homestead (i.e. *Butler* 53, *Short* 1554, *Short* 2038, and the type colln).

ECOLOGY & REPRODUCTIVE BIOLOGY:

Restricted to arid shrubland. Collectors notes include 'Amongst open shrubland. In reddish brown sandy clay.' and 'Flat sand plain. In open areas between shrubs of *Eremophila*, *Hakea* and chenopod shrubs. Associated with annual composites such as *Pogonolepis* sp., *Gnephosis* spp. and *Actinobole condensatum*.'

A P/O of 2,428 was determined from a single individual of *Short* 2484 (type).

NOTES:

1. The specific epithet refers to the spatulate leaves which, along with the branching habit, readily differentiate this species from its closest relatives, *C. pseudevax* and *C. oldfieldianus*. Spatulate leaves do occur in *C. viscosus* but it is readily differentiated from *C. spatulatus* by the presence of the sticky florets and the absence of paleae.

SELECTED SPECIMENS EXAMINED (Total 5):

Western Australia—Boologooro, 1963, *Butler* 53 (PERTH); Wooramel Roadhouse, 17.viii.1986, *Lander* 1341, *Fuhrer & Short* (AD, BRI, CANB, MEL, NSW, PERTH).

2. *Chthonocephalus oldfieldianus* P. S. Short, *sp. nov.*

Chthonocephalus *sp. aff. pseudevax* Steetz, Short, *Muelleria* 4:395-417 (1981).

Herba annua, caule inconspicuo; quaeque planta glomerulus rosula foliorum, c. 0.7–4 cm diametro. *Folia* oblanceolata usque obovata, c. 0.5–2.4 cm longa, 0.25–0.7 cm lata, basi hyalina, tomentosa. *Glomeruli* plerumque transverse ellipsoidei usque lenticulares, raro depresso late usque depresso ovoidei, c. 0.4–0.5 cm alti, c. 0.6–2.4 cm diametro; bracteae glomerulos subtendentes uni-vel bi-seriatae, oblongae, c. 2.8–3.5 mm longae, c. 1.4–1.5 mm latae, hyalinae, marginibus longe ciliatis; receptaculum glabrum. *Capitula* c. 5–50; bracteae intra capitulum 5–6, 1.8–2 mm longae, c. 0.2 mm latae, marginibus pauca pilosis. *Paleae* obovatae, 2.3–2.7 mm longae, 1.1–1.3 mm latae, paginis exteribus et marginibus pilis longis. *Flosculi* c. 9–16 in quoque capitulo; corolla 5-lobata, tubos c. 1.5–1.7 mm longos. *Stamina* 5; antherae 0.6–0.79 mm longae, sporangiis 0.45–0.6 mm longis, appendicibus terminalibus triangularibus, 0.14–0.2 mm longi. *Pollinis grana* in quoque anthera 200–440. *Cypselae* obovoideae. *Pappus* carens.

HOLOTYPE: Western Australia, 100 km N of Murchison River on NW coastal highway, c. 27° 00'S, 114° 38'E. Red sand dunes—dominant *Acacia ?linophylla*. Very common. 19.viii.1977, *Short* 394 (AD 97742595). ISOTYPE: AD (wet colln), CANB, K, MEL, PERTH.

Annual herb, stem inconspicuous, each plant consisting of a compound head surrounded by a flat, basal rosette of c. 7–30 leaves, the entire plant c. 0.7–4 cm diam. *Leaves* oblanceolate to obovate, the lower part somewhat hyaline, the entire leaf c. 0.5–2.4 cm long, 0.25–0.7 cm wide, tomentose, the innermost leaves fused together and partly making up the general receptacle. *Compound heads* usually transversely ellipsoid to lenticular but broadly depressed to depressed ovoid in small plants, c. 0.4–0.5 cm high, c. 0.6–2.4 cm diam.; bracts subtending compound heads in 1 or 2 rows, oblong, c. 2.8–3.5 mm long, c. 1.4–1.5 mm wide, hyaline, with long-ciliate margins; general receptacle disc-like, solid, glabrous. *Capitula* c. 5–50 per compound head; capitular bracts 5–6, 1.8–2 mm long, c. 0.2 mm wide and with a few c. 1–2 mm long hairs on the margins. *Paleae* obovate, 2.3–2.7 mm long, 1.1–1.3 mm wide, hyaline, the outer surface and margins with long hairs. *Florets* c. 9–16 per capitulum; corolla, 5-lobed, the tube c. 1.5–1.7 mm long. *Stamens* 5; anthers 0.6–0.79 mm long; microsporangia 0.457–0.6 mm long; apical appendages narrowly triangular, 0.14–0.2 mm long. *Pollen grains* 200–440 per anther. *Cypselas* (mature) not seen. *Pappus* absent. (Fig. 4)

DISTRIBUTION (Fig. 1):

Only known from the type collection.

ECOLOGY & REPRODUCTIVE BIOLOGY:

The type collection was gathered from red sand-dunes which were dominated by *Acacia* shrubs.

An average P/O of c. 1,540 has been recorded for the species (Short 1981).



Fig. 4. Holotype sheet of *C. oldfieldianus* (Short 394).

NOTES:

1. The specific epithet commemorates Augustus Frederick Oldfield who collected extensively in Tasmania and Western Australia. In 1858-1859 he collected in the vicinity of the Murchison River (Maiden 1911) and it was from this region that he collected the type specimen of *C. tomentellus*.

2. The innermost leaves of this species could possibly be regarded as bracts of the general involucre. However they are clearly delimited from the hyaline bracts, there being no gradation from leaf to hyaline bract as occurs, for example, in *C. muellerianus*.

3. Although it is only known from the type collection I suspect that the species will prove to be locally common. When I gathered the type collection, which includes about fifty individuals, there were hundreds of plants growing in an area of about 500 square metres and the population seemed to extend much further into the surrounding *Acacia* shrubland. However I have not observed the plant on subsequent visits to the general area in 1982, 1983 and 1986. Its absence probably reflects adverse seasonal conditions for the species although in 1986 its close relative, *C. pseudevax*, was common in that region. Following Leigh *et al.* (1984) the species should be given the conservation status '1K'.

3. ***Chthonocephalus pseudevax*** Steetz in Lehm., Pl. Preiss. 1:445 (1845); Benth., Fl. Austr. 3:582 (1867); J. M. Black, Fl. S. Aust. 1st ed. 651 (1929), 2nd ed. 932 (1957); Willis, Handb. Pl. Vict. 2:734 (1973); Grieve & Blackall, W. Aust. Wildfls 820, pl. 14 (1975); Short in Jessop, Fl. Central Aust. 387, fig. 496 (1981); Cunningham *et al.*, Pl. Western N.S.W. 711 (1982); Short in Jessop & Toelken, Fl. S. Aust. 1508 (1986). TYPE: 'In solo limoso arenoso ad fluvium Avon haud procul ab oppidulo York, d.10. Sept. 1839. Herb. Preiss. no. 2414b.' LECTOTYPE (here designated): In Nova Hollandia, (Swan-River Colonia) in solo limoso arenoso ad fluvium Avon, haud procul ab oppidulo York leg. cl. Preiss. . . emi 1843, *s. dat.*, Preiss 2414 (MEL 543283). ISOLECTOTYPES: GH (ex herb. F. W. Klatt, fragmentary), LD, MEL 542226 (ex herb. Sonder), MEL 543282, P, S. (See note 1 below).

Chthonocephalus drummondii A. Gray, Hook. J. Bot. Kew Gard. Misc. 3:178 (1851). TYPE: 'Swan River, Drummond.' LECTOTYPE (here designated): Sw. riv., *s. dat.*, *Drummond s.n.* (K). POSSIBLE ISOLECTOTYPE: GH (fragment only). REMAINING LECTOPARATYPES: Swan-River, 1843/1844, *Drummond s.n.*, (BM, K, P—2 sheets). (See note 2 below.)

Annual herb consisting of a compound head surrounded by a flat, basal rosette of c. 10–30 (c. 70) leaves, the entire plant (c. 0.7) 1–4 cm diam. *Leaves*, oblanceolate to obovate, the lower part somewhat hyaline, the entire leaf c. 0.6–2 (c. 3) cm long, 0.15–0.4 cm wide, tomentose, with both long thin hairs and short broad hairs. *Compound heads* usually transversely elliptic to lenticular but broadly depressed to depressed ovoid in small plants, c. 0.4–0.5 cm high, c. 0.5–2 cm diam.; bracts subtending compound heads absent; general receptacle disc-like, solid, glabrous. *Capitula* (2) 5–30 (c. 40) per compound head; capitular bracts c. 5–6, c. 3.3–3.8 mm long, c. 0.3–0.7 mm wide, the outer surface of the midrib and the hyaline margins with long hairs. *Paleae* elliptic, 2.9–3.4 mm long, 1.3–1.7 mm wide, hyaline, the margins entire to slightly laciniate and/or with a few long cilia. *Florets* c. 10–40 per capitulum; corolla yellow, 3, 4 (5)-lobed, the tube 1.6–2 mm long. *Stamens* 3, 4 (5); anthers 0.32–0.5 mm long; microsporangia 0.17–0.3 mm long; apical appendage widely deltate, c. 0.1–0.2 mm long; microsporangia 0.17–0.3 mm long. *Pollen grains* 20–60 per anther. *Cypselas* polymorphic, the majority c. 0.5–0.6 mm long, c. 0.35 mm diam. but a few (c. 5%) c. 0.9–1 mm long, c. 0.6–0.7 mm diam. *Pappus* absent.

DISTRIBUTION (Fig. 1):

Widespread across much of Australia, occurring between latitudes c. 25° S and c. 36° S and west of longitude c. 148° E.

ECOLOGY & REPRODUCTIVE BIOLOGY:

C. pseudevax occupies a variety of habitats, commonly occurring in sand or sandy loam depressions on granite outcrops and in sandy soil amongst samphire and *Melaleuca* around saline depressions. It is also common in open areas between

shrubs and trees of various semi-arid and arid zone communities which favour sandy soil.

An average pollen:ovule ratio of c. 150 has been recorded for the species.

NOTES:

1. The selection of MEL 543283 as the lectotype of *Chthonocephalus pseudevax* is consistent with the argument previously put (Short & Sinkora 1988) that in the case of names originally coined by Steetz specimens in his own herbarium should usually be chosen as the lectotype.

The use of the number *Preiss 2414b* in the protologue, not *Preiss 2414* as on the lectotype, merely reflects a duplication of numbers for Preiss collections. The duplication of numbers was presumably not noticed until after Steetz had received his specimens.

2. Gray (1851) described *C. drummondii* from a collection made by James Drummond in Western Australia and forwarded to him by Sir William Hooker. At K there is a sheet containing three individual plants plus an envelope containing fragments. This sheet, which I have chosen as the lectotype of *C. drummondii*, is annotated 'Chthonocephalus Drummondii n.sp.' in Gray's hand. A fragmentary collection at GH is presumably a duplicate of the lectotype. It is contained within an envelope, is labelled in Gray's hand as 'Chthonocephalus Drummondii' and like the lectotype lacks a Drummond collection number.

Collections labelled as *Drummond 185* exist in BM, P (2 sheets) and K. One of the sheets in P is labelled as 'Chthonocephalus n.sp.' in Gray's hand and was probably annotated by Gray when he visited Paris during his journey to Europe from June 1850 to August 1851 (Farlow 1888). The collections are regarded here as remaining syntypes and isosyntypes of *C. drummondii*. They possibly could be regarded as isolectotypes as they bear a strong resemblance to the lectotype collection.

3. The species exhibits variation with respect to leaf size and number, specimens from southern localities tending to have smaller and fewer leaves than plants found elsewhere. There is also noticeable variation in the density of hairs on the leaves and the presence or absence of ciliate margins on the paleae. The variation observed does not warrant formal recognition.

SELECTED SPECIMENS EXAMINED (Total c. 160):

Western Australia—Near British King Mine, 13.viii.1977, *Barker 1923* (AD); 32 km ENE of Cosmo Newberry, 1.ix.1973, *Chinnock 687* (AD); c. 10 km from Three Springs on Morawa road, 15.viii.1977, *Short 354* (AD); S of Beacon Hill, 28.viii.1968, *Wilson 7391* (AD).

Northern Territory—Yununba Hill, 21.viii.1973, *Donner 4331* (AD); Ayers Rock, 24.vii.1973, *Latz 4133* (AD, DNA).

South Australia—Arcoona, 23.viii.1956, *Lothian 2060* (AD); c. 146 km S of Kingoonya, 26.vii.1968, *Orchard 940* (AD); Carapsee Hill, 23.ix.1978, *Short 768* (AD).

Queensland—Gilruth Plains, 17.ix.1938, *Everist 1645* (BRI).

New South Wales—Dunderboo Range, 1.ix.1969, *Dunlop 1517* (CBG); 11.2 km NW of Condoblin, 18.ix.1971, *Lander 26B* (NSW); 25 miles SE of Louth, 20.ix.1966, *Moore 4022* (CANB).

Victoria—Wyperfeld National Park, 4.ix.1978, *Muir 5886* (MEL); Rocket Lake, 2.viii.1968, *Willis s.n.* (MEL 85307).

4. *Chthonocephalus tomentellus* (F. Muell.) Benth., Fl. Austr. 3:581 (1867); Grieve & Blackall 4:820 (1975).—*Lachnothalamus tomentellus* F. Muell., Fragm. 3:156 (1863). TYPE: 'In planitiebus arenosis ad ostium fluminis Murchinson. Oldfield.' LECTOTYPE (here designated): Sand Plain, Mouth of Murchison R., W. Aust., s. dat., Oldfield s.n. (MEL 542229). ISOLECTOTYPE: K.

Annual herb. Stem simple or forming major branches at basal nodes; major axes prostrate to ascending, c. 1.5–14 cm long, hairy. *Leaves*, obovate to oblanceolate or elliptic 0.5–3.5 cm long, c. 0.2–0.5 cm wide, tomentose, with both long thin hairs and short broad hairs. *Compound heads* spheroid to transversely ellipsoid, c. 0.4–0.7 cm high, c. 0.4–1.3 cm diam.; bracts subtending compound heads inconspicuous, in 1 or 2 ill-defined rows, hyaline, elliptic or ovate, 2.7–3 mm long,

c. 1–1.6 mm wide, stereome variably conspicuous, the lamina with long hairs on the margins; general receptacle disc-like but not entire, hairy. *Capitula* 8–40 per compound head; capitular bracts 4–6, oblanceolate or spatulate, c. 1.5–1.7 mm long, c. 0.4–0.5 mm wide, with long hairs on the outer surface. *Paleae* elliptic or ovate, 1.9–2.4 mm long, 0.8–1.3 mm wide, hyaline, with long hairs on the outer surface, the hairs usually entwining 1 or sometimes 2 florets. *Florets* (2)5–27 per capitulum; corolla yellow, 5-lobed, the tube c. 1.3–1.6 mm long. *Stamens* 5; anthers 0.78–0.82 mm long; microsporangia 0.6–0.66 mm long; apical appendage triangular, 0.16–0.18 mm long. *Pollen grains* c. 320 per anther. *Cypselas* 0.5 mm long, c. 0.35 mm diam. *Pappus* absent.

DISTRIBUTION (Fig. 1):

Restricted to the Shark Bay–Murchison River region of Western Australia.

ECOLOGY & REPRODUCTIVE BIOLOGY:

The species seems to favour deep sandy soils. With the exception of the following collectors' notes, 'growing in red sand bordering saline clay depression' and 'red sand' information on the habitat of the species is not available.

A P/O of 1,688 was determined for a single floret of *Short 439*.

SPECIMENS EXAMINED:

Western Australia—Shark Bay, 26.viii.1931, *Blackall 544* (PERTH); Shark Bay, 7.ix.1940, *Blackall 4642* (PERTH); Useless Harbour, s. dat., *Brown s.n.* (MEL 85335); 36 miles S of Denham, 26.viii.1969, *George 9556* (PERTH); Between the Murchison River & Shark Bay, -x.1877, *Mueller s.n.* (MEL 85332, PERTH); Hamelin Harbour, Shark Bay, -x.1877, *Mueller s.n.* (MEL 85333); 57 km from Denham [toward] Overlander Roadhouse, 21.viii.1977, *Short 439* (AD).

5. *Chthonocephalus muellerianus* P. S. Short, *sp. nov.*

Herba annua, caule simplici vel e nodis basalibus ramificantibus, axibus maioribus prostratis usque ascendentibus, 2–7.5 cm longis. Folia obovata vel elliptica, 0.5–2 cm longa, c. 0.2–0.7 cm lata, pilis longis tenuibus et brevibus latis. Glomeruli spheroides usque transverse ellipsoidei, c. 0.4–0.7 cm longa, c. 0.4–1 cm diametro; bracteae glomerulos subtendentes c. 5–10, ellipticae, c. 0.4–0.5 cm longae, c. 0.13–0.25 cm latae, foliiformes sed interdum apicibus hyalinis, pilosae; receptaculum villosum. Capitula c. 8–35; bracteae intra capitulum 5–6, 2.8–3.1 mm longae, c. 0.3–0.6 mm latae, marginibus et regione apicali pilosis. Paleae ellipticae vel oblongae, 2.5–3.5 mm longae, 1.4–2.1 mm latae, hyalinae, paginis exterioribus glabris vel sparse pilosis. Flosculi c. 5–25 in quoque capitulo; corolla 5-lobata, tubos 2–2.4 mm longos. Stamina 5; antherae 0.82–1 mm longae, sporangiis 0.63–0.84 mm longis, appendicibus terminalibus triangularibus, 0.17–0.2 mm longi. Pollinis grana c. 400 in quaque anthera. Cypselae c. 0.5–0.55 mm longae, c. 0.35 mm diametro. Pappi setis 6–9(–11) plumosis, corollae tubi circa aequantibus.

HOLOTYPE: Western Australia, 14 km S of Billabong Roadhouse. 26° 56'S, 114° 39'E. 11.ix.1986, *Short 2831, Amerena & Fuhrer* (MEL 1555860). **ISOTYPI:** AD, PERTH.

Annual herb, stem simple or forming up to c. 10 major branches at basal nodes; major axes prostrate to ascending, c. 2–7.5 cm long. *Leaves* obovate or elliptic, 0.5–2 cm long, c. 0.2–0.7 cm wide, with both long thin hairs and short broad hairs. *Compound heads* spheroid to transversely ellipsoid, c. 0.4–0.7 cm long, c. 0.4–1 cm diam.; bracts subtending compound heads c. 5–10, elliptic, c. 0.4–0.5 cm long, c. 0.13–0.25 cm wide, leaf-like but sometimes with hyaline apices, hairy; receptacle disc-like but not entire, villous. *Capitula* c. 8–35; capitular bracts 5–6, oblanceolate or spatulate, 2.8–3.1 mm long, c. 0.3–0.6 mm wide, with long hairs on the margins and on the outer surface near the base of the hyaline apex. *Paleae* elliptic or oblong, 2.5–3.5 mm long, 1.4–2.1 mm wide, hyaline, outer surfaces glabrous or with a few long hairs. *Florets* c. 5–25; corolla 5-lobed, the tube 2–2.4 mm long. *Stamens* 5; anthers 0.82–1 mm long; microsporangia 0.63–0.84 mm long; apical appendage triangular, 0.17–0.2 mm long. *Pollen grains* c. 400 per anther. *Cypselas* obovoid, c. 0.5–0.55 mm long, c. 0.35 mm diam., brown. *Pappus* with 6–9 (–11) plumose bristles with dense apical tufts, the entire bristles approximately the length of the corolla tube. (Figs 2, 5)

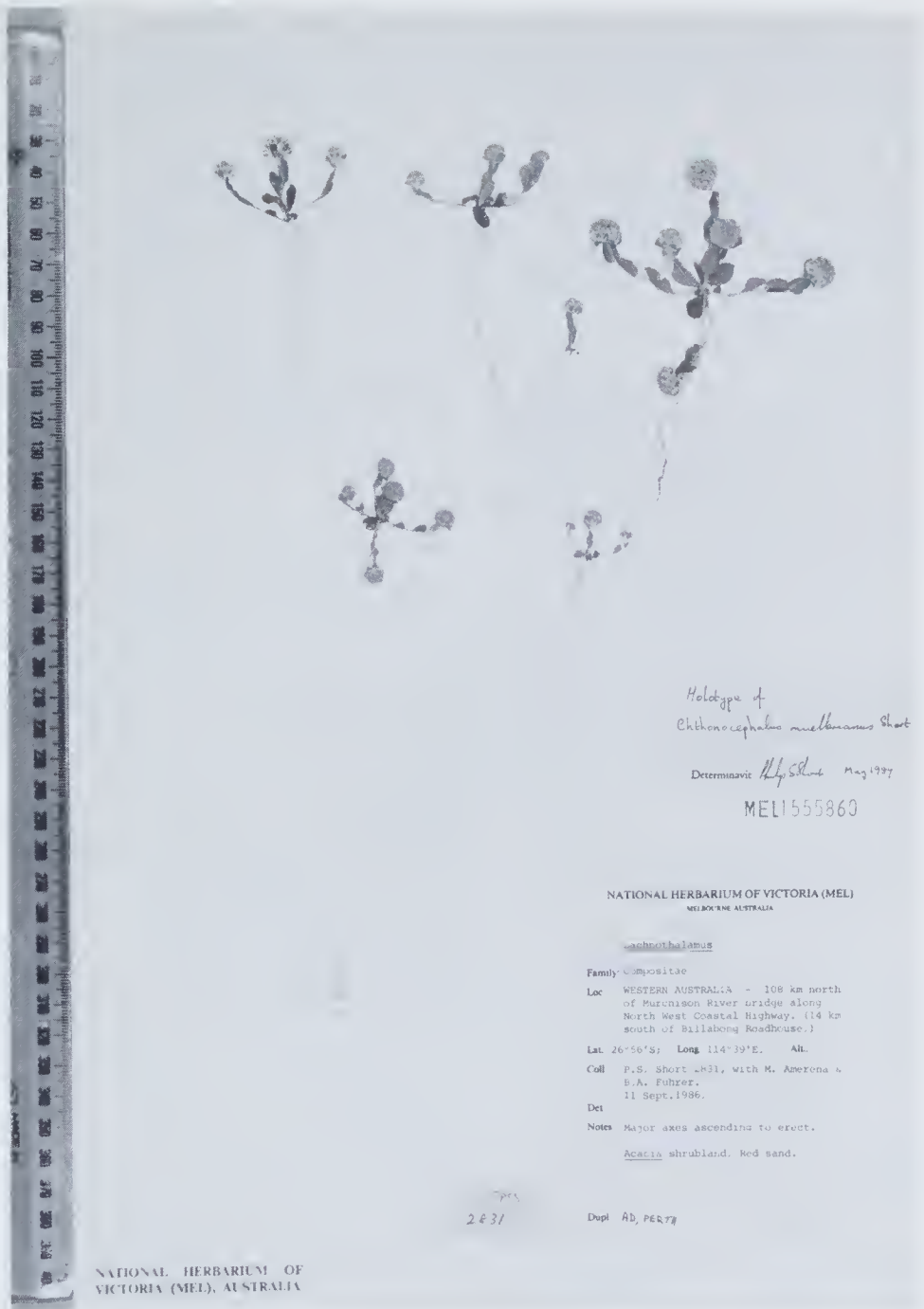


Fig. 5. Holotype sheet of *C. muellerianus* (Short 2831 et al.).

DISTRIBUTION:

Restricted to the Shark Bay region of Western Australia.

ECOLOGY & REPRODUCTIVE BIOLOGY:

Information on the habitat of the species is scarce but it is evident that it

grows in sand. It has been recorded as growing in a shrub community with *Eremophila leucophylla* as the dominant species.

A P/O of 1,998 was recorded for a single floret of *Short 419*.

NOTES:

1. The specific epithet commemorates Ferdinand J. H. Mueller. One of the many species described by him was the closely related *C. tomentellus*.

2. The species differs from *C. tomentellus* in having a more well-defined general involucre (many bracts being leaf-like), the plumose pappus, and the frequently glabrous paleae.

SPECIMENS EXAMINED:

Western Australia—near Shark Bay, 17.ix.1941, *Gardner 6011* (PERTH); 22.5 km S of Wannoo, 17.ix.1968, *Phillips WA68/1122* (PERTH); c. 57 km N of Murchison River Bridge, 19.viii.1977, *Short 391* (AD); c. 28 km S of Overlander Roadhouse, 20.viii.1977, *Short 419* (AD).

6. *Chthonocephalus viscosus* P. S. Short, *sp. nov.*

Herba annua; quaeque planta glomerulus rosula foliorum prostratorum usque erectorum, vel planta ramificans sed glomerulo proxime super radicum, axibus maioribus prostratis, ad c. 9 cm longis, gossypinis. *Folia* oblanceolata vel spatulata vel sublinearia, 0.4–6.5 cm longa, 0.05–0.9 cm lata, gossypina. *Glomeruli* depresso late usque depresso ovoidei, 0.4–1 cm alta, 0.5–2.5 cm diametro; bractae glomerulos subtendentes involucrem conspicuum longitudine glomeruli formantes, foliiformes, paginae exterior lanata, interior glabra; receptaculum brevissime, ramosum sparsim pilosum. *Capitula* usque ad c. 50; receptaculum glabrum. *Bractae intra capitula* c. 6–7, uniseriatae, plerumque hyalinae sed costa prominentie basi per longitudinem 3/5–2/3 bractae extendenti, marginibus longe ciliatis, apici longe piloso. *Paleae* absentes. *Floresculi* 6–17; corolla 5-lobata, tubos 2.1–2.5 mm longos. *Stamina* 5; antherae 0.96–1 mm longae, sporangii 0.76–0.8 mm longis, appendicibus terminalibus triangularibus, 0.18–0.23 mm longi. *Cypselae* obovoideae, 0.35–0.4 mm longae, 0.25–0.3 mm diametro; carpodium conspicuum. *Pappus* absens.

HOLOTYPE: Western Australia, c. 18 km from Bandy Homestead along road to Laverton. c. 27° 50'S, 122° 19'E, 21.viii.1982, *Short 1541* (MEL 621022). ISOTYPE: AD, K, PERTH, S.

Annual herb consisting of a compound head (rarely a single capitulum) surrounded by prostrate to erect leaves, or branching at basal and near basal nodes, if branching then with a compound head immediately above the root, the major axes prostrate, to c. 9 cm long, cottony. *Leaves* oblanceolate or spatulate or linear, 0.4–6.5 cm long, 0.05–0.9 cm wide, cottony. *Compound heads* broadly depressed to depressed ovoid, 0.4–1 cm high, 0.5–2.5 cm diam.; bracts subtending compound heads forming a conspicuous involucre about as long as the head, leaf-like, the outer surface woolly, inner surface glabrous; general receptacle shortly branched, sparsely hairy. *Capitula* to c. 50 per compound head; receptacle glabrous; capitular bracts c. 6–7, uniseriate, mainly hyaline but with a prominent midrib extending 3/5–2/3 the length margins long-ciliate, with long hairs near the apex. *Paleae* absent. *Florets* 6–17 per capitulum; corolla 5-lobed, the tube 2.1–2.5 mm long. *Stamens* 5; anthers 0.96–1 mm long; microsporangia 0.76–0.8 mm long; apical appendage triangular, 0.18–0.23 mm long. *Cypselas* obovoid, 0.35–0.4 mm long, 0.25–0.3 mm diam.; carpodium conspicuous. *Pappus* absent. (Fig. 6)

DISTRIBUTION (Fig. 1):

Restricted to central Western Australia between latitudes c. 24° and 28° S and longitudes c. 117° and 123° E.

ECOLOGY & REPRODUCTIVE BIOLOGY:

The type collection was gathered from an area of open mulga scrub with an understorey of herbs. Plants were growing in a loamy soil overlain by ironstone gravel. Other collectors' notes include '*Acacia aneura*—*Danthonia* community'.



Fig. 6. Holotype sheet of *C. viscosus* (Short 1541).

'Rocky sandstone breakaway in mulga shrubland' and 'on wandarrie country. On bank areas (deep sand) and yellow clay-loam'.

A P/O of 1,812 has been recorded for a single floret of Short 1541 (type).

NOTES:

1. The specific epithet alludes to the sticky corolla tubes which cause florets to adhere to one another in the capitula.

SELECTED SPECIMENS EXAMINED (Total 15):

Western Australia—Meekatharra, 24.viii.1963, *Aplin* 2469 (PERTH); 5 miles N of Cunya Homestead, 15.ix.1973, *Beard* 6563 (NSW, PERTH); 16 km S of 10 Mile Tank, 3.ix.1973, *Chinnock* 729 (AD); 3 miles SW of Millrose, 8.ix.1958, *Speck* 1378 (CBG n.v., MEL); 56 km from Meekatharra along road to Wiluna, 7.ix.1982, *Strid* 20208 (AD, C n.v., MEL, PERTH, S).

EXCLUDED SPECIES

Chthonocephalus pygmaeus (A. Gray) Benth., Fl. Austr. 3:582 (1867). [= *Siloxerus pygmaeus* (A. Gray) P. S. Short, *Muelleria* 5:208 (1983).]

Chthonocephalus multiceps J. H. Willis, Proc. Roy. Soc. Queensl. 62:105, pl.7, figs 25–33 (1952). [Congeneric with *Calocephalus aervoides* (F. Muell.) Benth., Fl. Austr. 3:576 (1867).]

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NEW TAXA AND NEW COMBINATIONS IN AUSTRALIAN GNAPHALIINAE (INULEAE: ASTERACEAE).

by

P. S. SHORT*

ABSTRACT

Short, P. S. New taxa and new combinations in Australian Gnaphaliinae (Inuleae: Asteraceae). *Muelleria* 7(2): 239–252 (1990). One new genus, *Tietkensia* P. S. Short is described, two species of *Angianthus* Wendl., two species of *Gnephosis* Cass. and one species of *Millotia* Cass. are described for the first time, and species of *Scyphocoronis* A. Gray and *Toxanthus* Turcz. are referred to *Millotia*. New species and new combinations are: *Angianthus newbeyi* P. S. Short, *A. uniflorus* P. S. Short, *Gnephosis cassiniana* P. S. Short, *G. setifera* P. S. Short, *Millotia incurva* (D. A. Cooke) P. S. Short, *M. major* (Turcz.) P. S. Short, *M. muelleri* (Sond.) P. S. Short, *M. perpusilla* (Turcz.) P. S. Short, *M. steetziana* P. S. Short and *Tietkensia corrickiae* P. S. Short.

INTRODUCTION

For some years I have been aware of a number of undescribed Australian taxa attributable to the Inuleae (*sensu* Merxmüller *et al.* 1978). I have also felt that the circumscription of a number of genera leaves much to be desired (*e.g.* Short *et al.* 1989). With accounts of the Asteraceae soon due for the *Flora of Australia* some of the new taxa are described and some new combinations are made in this paper.

TAXONOMY

Angianthus Wendl.

Subsequent to my revision of *Angianthus* Wendl. (Short 1983) a number of new or possibly new taxa attributable to this genus have been discovered. Two of these are here described as new species.

Angianthus newbeyi P. S. Short, *sp. nov.*

Herba annua. Axes majores ascendentes usque erecti, usque ad c. 5 cm longi, gossypini. *Folia* alterna, linearia vel lanceolata vel anguste oblonga, c. 0.4–1.3 cm longa, 0.07–0.1 cm lata, gossypina. *Glomeruli* anguste ellipsoidei vel lanceoloidei, c. 0.7–1.5 cm longi, c. 0.3–0.4 cm diametro; bractae glomerulos subtendentes inconspicuae sed aliquot bractae foliiformes praesentes. *Capitula* c. 20–50. *Bractae capitulum subtendentes* 2–3, obovatae vel ellipticae, 2.1–2.9 mm longae, 0.9–1.2 mm latae; costa viridi ad apicem pilosa; lamina supera pars vix constricta, hyalina marginibus pilis. *Bractae intra capitulum*: duo concavae 2–2.3 mm longae, costa glabra vel pilifera; duo planae, obovatae, 2.1–2.2 mm longae, 1–1.2 mm latae, in infima tertia parte attenuatissimae, glabrae. *Flosculi* 2; corolla 5-lobata, tubos 1.3–1.5 mm longos. *Stamina* 5; antherae c. 0.87–0.89 mm longae, sporangiis c. 0.69–0.7 mm longis, appendice terminali c. 0.18–0.19 mm longa. *Cypselae* maturae non visae. *Pappus* annularis, c. 0.1–0.2 mm longus laceratus.

HOLOTYPE: Western Australia, 18 km E of Jyndabinbin Rocks, c. 50 km SE of Norseman, 22.ix.1980, *Newbey 7567* (PERTH).

Annual herb. Major axes ascending to erect, up to c. 5 cm long, cottony. *Leaves* alternate, linear or lanceolate or narrowly oblong, c. 0.4–1.3 cm long, 0.07–0.1 cm wide, cottony. *Compound* heads narrowly ellipsoid or lanceoloid, 0.7–1.5 cm long, 0.3–0.4 cm diam; bracts subtending compound heads not forming a conspicuous involucre but a few leaf-like bracts present. *Capitula* c. 20–50 per compound head. *Capitulum subtending bracts* 2–3, obovate or elliptic, 2.1–2.9 mm long, 0.9–1.2 mm

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

wide, mainly hyaline but with a green midrib extending c. $2/3$ the length of the bract; midrib with long hairs at the apex; lamina barely constricted in the upper part, with long hairs on the margin. *Capitular bracts* with the two concave ones 2–2.3 mm long, the midrib glabrous or with a few long hairs; inner bracts 2, obovate, 2.1–2.2 mm long, 1–1.2 mm wide, abruptly attenuated in the lower $1/3$, the edge of the bracts incurved so as to slightly cover the florets, glabrous. *Florets* 2; corolla 5-lobed, tube 1.3–1.5 mm long. *Stamens* 5; anthers c. 0.87–0.89 mm long, with microsporangia c. 0.69–0.7 mm long, the apical appendage c. 0.18–0.19 mm long. *Pollen grains* c. 400 per anther. *Cypselae* (mature) not seen. *Pappus* a jagged ring, c. 0.1–0.2 mm long.

DISTRIBUTION:

Western Australia. Only known from the type locality [and possibly from Dundas Rocks—re *Short 1112*].

ECOLOGY & REPRODUCTIVE BIOLOGY:

Newbey recorded the following information on the holotype sheet: 'Common in patches in *Melaleuca* aff. *cuticularis* Scrub . . . Well-drained, subsaline sand. Moderately exposed short slope into salt lake.'

A pollen:ovule ratio of 1,190, determined from a single floret from the holotype, suggests that plants commonly cross-pollinate.

NOTES:

1. The specific epithet commemorates Ken Newbey (1936–1988) of Ongerup, Western Australia (Kenneally 1988).

2. This species appears to be most closely related to *A. conocephalus* (J. M. Black) P. S. Short, a species which occurs in the adjacent Nullarbor Plain region, and *A. cornutus* P. S. Short, which is found to the north of *A. newbeyi* in the vicinity of Carnegie, Leonora and Wiluna. *A. conocephalus* is readily differentiated as it has ovoid compound heads about 0.8–1.6 cm long and less hairy, semisucculent, comparatively bright green leaves. In that species the uppermost leaves also have a small hyaline apex and merge gradually with the inner bracts of the general involucre. In *A. newbeyi* the general involucre is not well-formed, the leaf-like bracts could be interpreted as leaves, and a gradation from leaf to bract is not particularly pronounced. *A. cornutus* is readily differentiated by the pronounced general involucre and the lack of a pappus. Although the holotype does not contain completely mature specimens a jagged ring-like pappus was discernible in *A. newbeyi*.

2. In the previously published key to species (Short 1983) *A. newbeyi* should key to lead 17. In the same publication *Short 1112*, a collection of somewhat immature plants, was tentatively referred to *A. cornutus*. It seems more likely that it should be referred to *A. newbeyi*.

3. The species is only known with certainty from the type locality and is therefore a candidate for the conservation status '1K' (Leigh *et al.* 1984).

Angianthus uniflorus P. S. Short, *sp. nov.*

Herba annua. Axes maiores ascendentes usque erecti, usque ad 7 cm longi, gossypini. *Folia* alterna, linearia, lanceolata vel oblanceolata, c. 0.5–1.05 cm longa, 0.05–0.15 cm lata, gossypina. *Glomeruli* ovoidei usque late ovoidei vel ellipsoidei usque late ellipsoidei, 0.6–1 cm longi, 0.5–0.7 cm diametro; bractae glomerulos subtendentes involucrium conspicuum longitudine c. $1/3$ glomeruli formantes, bractae foliiformes sed apicibus hyalinis. *Capitula* c. 30–60. *Bractae capitulum* subtendentes et bractae intra capitulum planae usque conduplicatae, anguste ellipticae vel lanceolatae, 2.2–3.2 mm longae, 0.6–0.9 mm latae, praecipue hyalinae sed costa viridi lamina supera pars saepe constricta, saepe apice flavido; bractae raro glabrae, plerumque pilis longis. *Flosculi* 1; corolla 5-lobata, tubos 1.7–2.2 mm longos. *Stamina* 5, antherae 1.14–1.17 mm longae, sporangii 0.9–0.98 mm longi, appendice terminali 0.19–0.24 mm longa *Cypselae* maturae non visae. *Pappus* cyathiformis, 0.3–0.4 mm longus, laceratus.

HOLOTYPE: Western Australia, c. 15 km S of Cue. 27° 38'S, 117° 52'E. 28.ix.1986, P. G. Wilson 12331 (PERTH). ISOTYPE: MEL 1553226.

Annual herb. Major axes ascending to erect, to c. 7 cm long, cottony. *Leaves* alternate, linear, lanceolate or oblanceolate, c. 0.5–1.05 cm long, 0.05–0.15 cm wide, cottony. *Compound heads* ovoid to widely ovoid or ellipsoid to widely ellipsoid, 0.6–1 cm long, 0.5–0.7 cm diam; bracts subtending compound heads forming a conspicuous involucre c. 1/3 the length of the head, bracts leaf-like but with hyaline apices. *Capitula* c. 30–60 per compound head. *Capitulum subtending bracts and capitular bracts* flat to conduplicate, narrowly elliptic or lanceolate, 2.2–3.2 mm long, 0.6–0.9 mm wide, mainly hyaline but with a green midrib extending c. 1/3–3/4 the length of the bract; lamina often with a distinct constriction in the dorsal part, apex often yellowish; rarely glabrous, usually with long hairs, particularly near the apex of the midrib. *Florets* 1 per capitulum; corolla 5-lobed, tube 1.7–2.2 mm long. *Stamens* 5; anthers 1.14–1.17 mm long, with microsporangia 0.9–0.98 mm long, the apical appendage 0.19–0.24 mm long. *Cypselas* (mature) not seen. *Pappus* a jagged cup, 0.3–0.4 mm long.

DISTRIBUTION:

Only known from the type locality near Cue, Western Australia.

ECOLOGY & REPRODUCTIVE BIOLOGY:

It is recorded on the type collection that the species was 'growing on lower margin of calcrete rise near gypseous salt lake'.

A pollen:ovule ratio of 4.820, determined from a single floret of *Wilson 12331*, suggests that the species commonly cross-pollinates.

NOTES:

1. The specific epithet reflects the fact that this is one of only two species of *Angianthus* with single-flowered capitula. This means that in the previously published key to species (Short 1983) *A. uniflorus* will key to lead 2 and be associated with *A. microcephalus*, the other species with a single floret in each capitulum. The latter is readily distinguished by the pappus which consists of two or three scales, each of which terminates in a barbellate bristle.

2. In the majority of species of *Angianthus* at least one capitulum-subtending bract and four capitular bracts (the outer two conduplicate, the inner two flat) are usually distinguishable. This is not the case in *A. uniflorus* and probably reflects that fact that one, not two florets occur in each capitulum, floret number to some extent determining the arrangement of bracts. In all other respects the bracts resemble those typically found in *Angianthus*.

3. The species is only known to me from the type locality and is therefore a candidate for the conservation status '1K' (Leigh *et al.* 1984).

Gnephosis Cass.

I have noted elsewhere (Short 1897, 1990) that *Gnephosis* Cass. is an unnatural genus and that *Gnephosis* s. str. possibly contains only six species, i.e. *G. drummondii* (A. Gray) P. S. Short, *G. multiflora* (P. S. Short) P. S. Short, *G. tenuissima* Cass., *G. tridens* (Short) P. S. Short and *G. trifida* (Short) P. S. Short and *G. uniflora* (Turcz.) P. S. Short. The aforementioned species have an erect habit, often elongated compound heads which lack a general involucre, an unbranched general receptacle, distinctive, leaf-like capitulum-subtending bracts and possess scale-like hairs on the leaves and major axes. Initially I felt that at least *G. setifera* was probably generically distinct from the other species mentioned, characterized by its prostrate habit, compound heads with a well developed involucre, a branched general receptacle, and a general vestiture of bristles, not scale-like hairs. However, with the discovery of *G. cassiniana*, my opinions have altered. This species looks very similar to two other, possibly conspecific species, *G. brevifolia* (A. Gray) Benth. and *G. eriocephala* (A. Gray) Benth. All three are characterized by compound heads which lack a general involucre.

a branched general receptacle, one or several leaf-like capitulum subtending bracts, and glabrous leaves. Some of these features are shared with either *G. setifera* or *G. tenuissima* and allied species with scale-like hairs.

Most importantly all of the species mentioned above are united by similarities in the fruit and capitular bracts. In all cases the fruit are small, pink or purple, glabrous or with scattered papillae, and have a thin pericarp which lacks sclerenchyma and contains two vascular bundles. Fruits do differ in the presence of what would normally be deemed a carpopodium. This always seems to be present in *G. tenuissima* and allied species but cannot be discerned in other species. However a short pedicel, resembling an annular carpopodium, is discernible on the partial receptacle of these species. Although there is considerable variation in the number of morphology of the capitulum-subtending bracts the capitular bracts have similar structure, always being essentially hyaline and with ciliate or long-ciliate margins.

Gnephosis cassiniana* P. S. Short *sp. nov.

Herba annua. Axes maiores erecti, 1–6 cm longi, glabri; caulis simplex vel e nodis basalibus ramificans. *Folia* ad basem opposita, supra alterna, sessilia, integra, succulenta, praecipue elliptica vel ovata sed infima linearia vel oblanceolata, 0.35–1.2 cm longa, 0.6–2.4 mm lata, glabra. *Glomeruli* ellipsoidei vel obovoidei, 0.35–1.2 cm longi, 0.25–0.8 cm diametro; bractae glomerulos subtendentes involucrium conspicuum non formantes sed aliquot bractae foliiformes praesentes; receptaculum glabrum vel sparse pilosum. *Capitula* (2)–6–30. *Bractae capitulum subtendentes* 1, foliiformes, succulentae, obovatae usque latissime obovatae vel circularis usque oblatae vel latissime ovatae, 2.8–3.8 mm longae, 1.7–3.9 mm latae, superis marginibus hyalinis, infernis marginibus longe pilosis. *Bractae intra capitulum* 9–12, anguste ellipticae vel lanceolatae vel interdum lineares, 1.7–3 mm longae, 0.2–0.4 mm latae; bractae marginibus longe pilosis, duo exteriores bractae virides; interiores in verticillis uno plusve praecipue hyalinae. *Receptaculum* glabrum. *Flosculi* 4–16; corolla 5-lobata, tubos 1.35–1.5 mm longos. *Styli* rami truncati. *Stamina* 5; antherae 0.72–0.8 mm longae, sporangiis 0.56–0.64 mm longis, appendice terminali 0.14–0.18 mm longa. *Cypselae* obovoideae, 0.4–0.5 mm longae, c. 0.3 mm diametro, roseae. *Pappus* absens.

HOLOTYPE: Western Australia, c. 2.5 km S of Binnu along Geraldton road. 28° 03'S, 114° 40'E. 20.ix.1983, *Short 2134* (MEL 693806). **ISOTYPI:** AD, CANB, MEL (wet colln), NSW, PERTH.

Annual herb, 1–6 cm high. *Major axes* erect, glabrous; stem simple or forming major branches at basal nodes; major axes sometimes developing minor shoots. *Leaves* opposite at the base, the upper ones alternate, sessile, entire, variably succulent, mainly elliptic or ovate but with the lowermost linear vel oblanceolate, 0.35–1.2 cm long, 0.6–2.4 mm wide, glabrous. *Compound heads* ellipsoid or obovoid, 0.35–1.2 cm long, 0.25–0.8 cm diam.; bracts subtending compound heads not forming a conspicuous involucre but several leaf-like bracts present, grading into capitulum-subtending bracts present, grading into capitulum-subtending bracts. *General receptacle* a simple axis with the capitula on very short peduncles (to c. 0.3 mm), glabrous or with a few long hairs. *Capitula* (2)–6–30 per compound head, each capitulum with 1 abaxial, leaf-like, variably succulent subtending bract that overlaps the capitular bracts. *Capitulum subtending bracts* ovate to widely depressed obovate or circular to oblate or very widely ovate, 2.8–3.8 mm long, 1.7–3.9 mm wide, the upper margins narrowly hyaline, the lower margins with long hairs, apex barely mucronate. *Capitular bracts* 9–12, narrowly elliptic or lanceolate or sometimes linear, 1.7–3 mm long, 0.2–0.4 mm wide, the outer pair of mainly green bracts enclosing one or more inner whorls of mainly hyaline bracts, all bracts with long hairs on the margins. *Partial receptacle* naked. *Florets* 4–16 per capitulum; corolla 5-lobed, tube 1.35–1.5 mm long; style branches truncate. Stamens 5; anthers 0.72–0.8 mm long, the microsporangia 0.56–0.64 mm long, the apical appendage 0.14–0.18 mm long. *Cypselas* obovoid, 0.4–0.5 mm long, c. 0.3 mm diam., pink. *Pappus* absent. (Fig. 1)

DISTRIBUTION:

Western Australia. Only known from the type locality near Binnu and from the western edge of Mongers Lake.

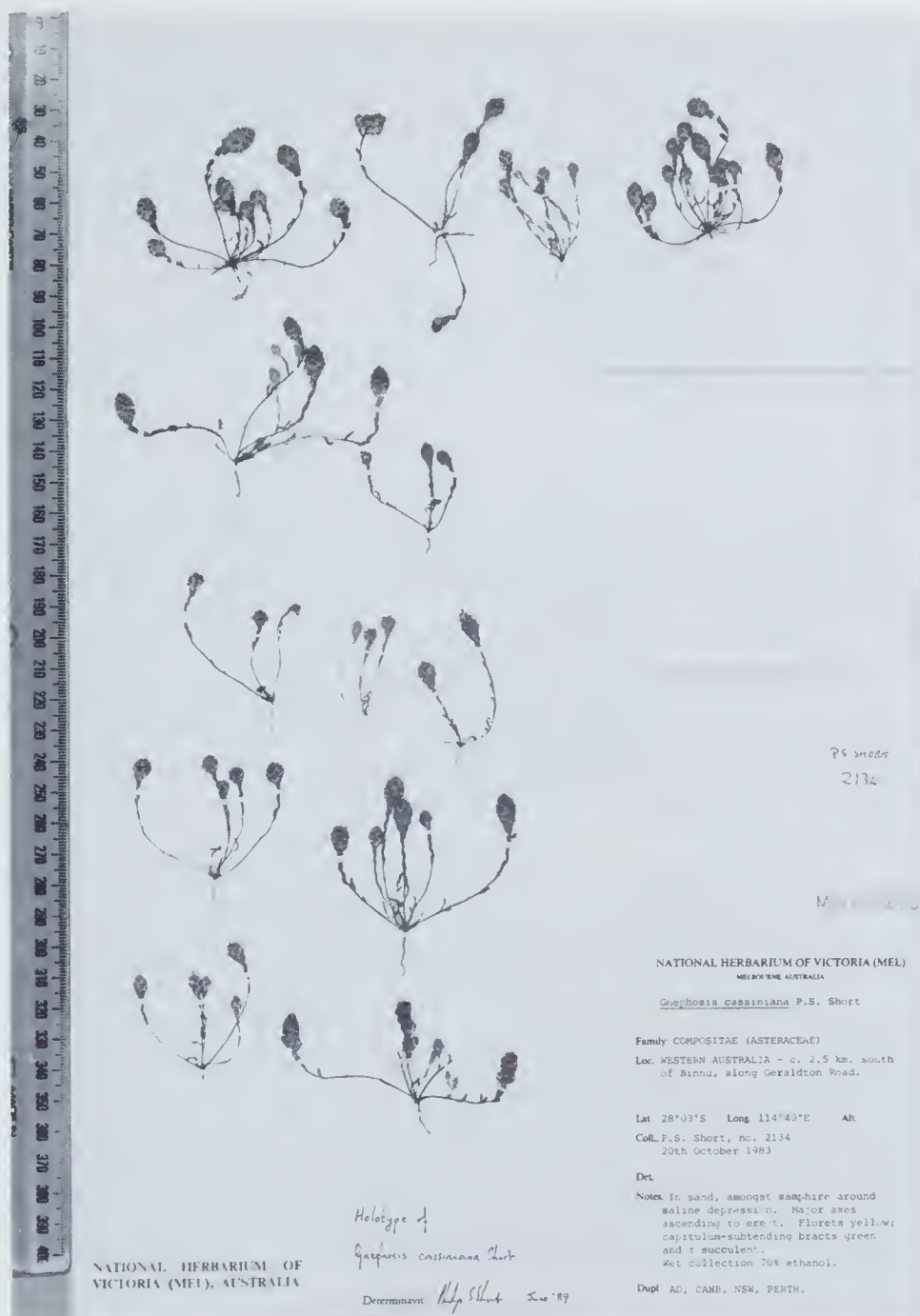


Fig. 1. Holotype sheet of *Gnephosis cassiniana* (Short 2134).

ECOLOGY & REPRODUCTIVE BIOLOGY:

At the type locality the plants were found growing amongst samphire on the margins of a saline depression. At Mongers Lake the species was recorded as growing in red sand.

A pollen:ovule ratio of 1,560, determined from a single floret of *Wilson 12298*, suggests that the species commonly cross-pollinates.

NOTES:

1. The specific epithet commemorates French botanist Alexandre-Henri Gabriel de Cassini (1781-1832).

2. This species seems to have its strongest affinities to *G. brevifolia* (A. Gray) Benth. and *G. eriocephala* (A. Gray) Benth. (both closely related to each other and possibly conspecific) but is readily distinguished by virtue of its succulent leaves and the well-developed hyaline margins and succulent nature of the capitulum-subtending bracts. It is also similar in habit to some forms of *G. tenuissima*, from which it is readily distinguished by the lack of scale-like hairs on the leaves and major axes.

SPECIMENS EXAMINED:

Western Australia—c. 2.5 km S of Binu, 11.ix.1986, *Short 2848, Amerena & Fuhrer* (MEL, PERTH); 6 km S of Warriadar HS near west bank of Mongers Lake, 26.ix.1986, *Wilson 12298* (MEL 1553236, PERTH *n.v.*).

Gnephosis setifera P. S. Short, *sp. nov.*

Herba annua, plerumque ramificans, interdum solum glomerulus sessilis in rosula basali foliarum; axes maiores prostrati, 0.2–0.5 cm longi, setis dispersis. *Folia* sessilia, integra, infima opposita, supera alterna, oblanceolata vel spathulata, 0.35–1.5 cm longa, 0.15–0.26 cm lata, setis dispersis. *Glomeruli* lati depressi ovoidei usque depressi ovoidei, 0.3–0.5 cm alti, 0.5–1.6 cm diametro; bractae glomerulos subtendentes involucrem conspicuum formantes, foliiformes, uno-vel duo-seriales; receptaculum ramosum. *Capitula* c. 10–45. *Bractae intra capitulum* duo vel tri-seriales, exteriores 1–4, foliiformes, setis et pilis longis-flexuosis, interiores c. 8–12, uno-vel duo-seriales, praecipue hyalinae, marginibus long ciliatis, pagina exteriori pilis longis flexuosis. *Flosculi* 5–11, hermaphroditi, tubularae; corolla 5-lobata. *Stamina* 5; antherae 0.85–0.88 mm longae, sporangiis 0.68–0.72 mm longiis, appendicibus terminalibus 0.15–0.18 mm longibus. *Cypselae* obovoideae, 0.44–0.57 mm longae, roseae; pericarpium fascibus vascularibus 2; carpodium absens. *Pappus* absens.

HOLOTYPE: Western Australia, c. 7 km south of Bunjil along road to Latham. 29° 42'S, 116° 24'E. 16.ix.1986, *Short 2955, Amerena & Fuhrer* (MEL 117004). **ISOTYPE:** PERTH.

Annual herb, sometimes a single compound head sessile in a basal rosette of leaves, usually branching; major axes prostrate, 0.2–0.5 cm long, with scattered bristles. *Leaves* sessile, entire, the lowermost opposite, the upper alternate, oblanceolate or spathulate, 0.35–1.5 cm long, 0.15–0.26 cm wide, with scattered bristles. *Compound heads* broadly depressed to depressed ovoid, 0.3–0.5 cm high, 0.5–1.6 cm diam.; bracts subtending the compound heads forming a conspicuous involucre, leaf-like, in 1 or 2 rows; general receptacle branching. *Capitula* c. 10–45 per compound head. *Capitular bracts* in 2 or 3 rows, c. the length of the florets; outer bracts 1–4, leaf-like, with bristles and long-flexuose hairs; inner bracts c. 8–12, in 1 or 2 rows, usually hyaline but partly green and opaque, the margins long-ciliate, the outer surface with some long-flexuose hairs. *Florets* 5–11 per capitulum, bisexual; corolla tubular, 5-lobed. *Stamens* 5; anthers 0.85–0.88 mm long, the microsporangia 0.68–0.72 mm long, the apical appendage 0.15–0.18 mm long. *Cypselas* obovoid, dark pink, 0.44–0.57 mm long, 0.27–0.33 mm diam.; pericarp with 2 vascular bundles; carpodium absent. *Pappus* absent. (Fig. 2)

DISTRIBUTION:

Western Australia. Only known from the Monger Drainage System (Bettenay & Mulcahy 1972).

ECOLOGY & REPRODUCTIVE BIOLOGY:

The species seems to be restricted to sandy saline soils. Collectors' notes include: 'in sand amongst *Gunniopsis* in a zone between the samphire of the saline depression and a sandy ridge dominated by *Melaleuca*' and 'in sand with *Halosarcia* and *Atriplex*'.

A pollen:ovule ratio of 1,664, determined from a single floret of *Short 2956 et al.*, suggests that plants commonly cross-pollinate.

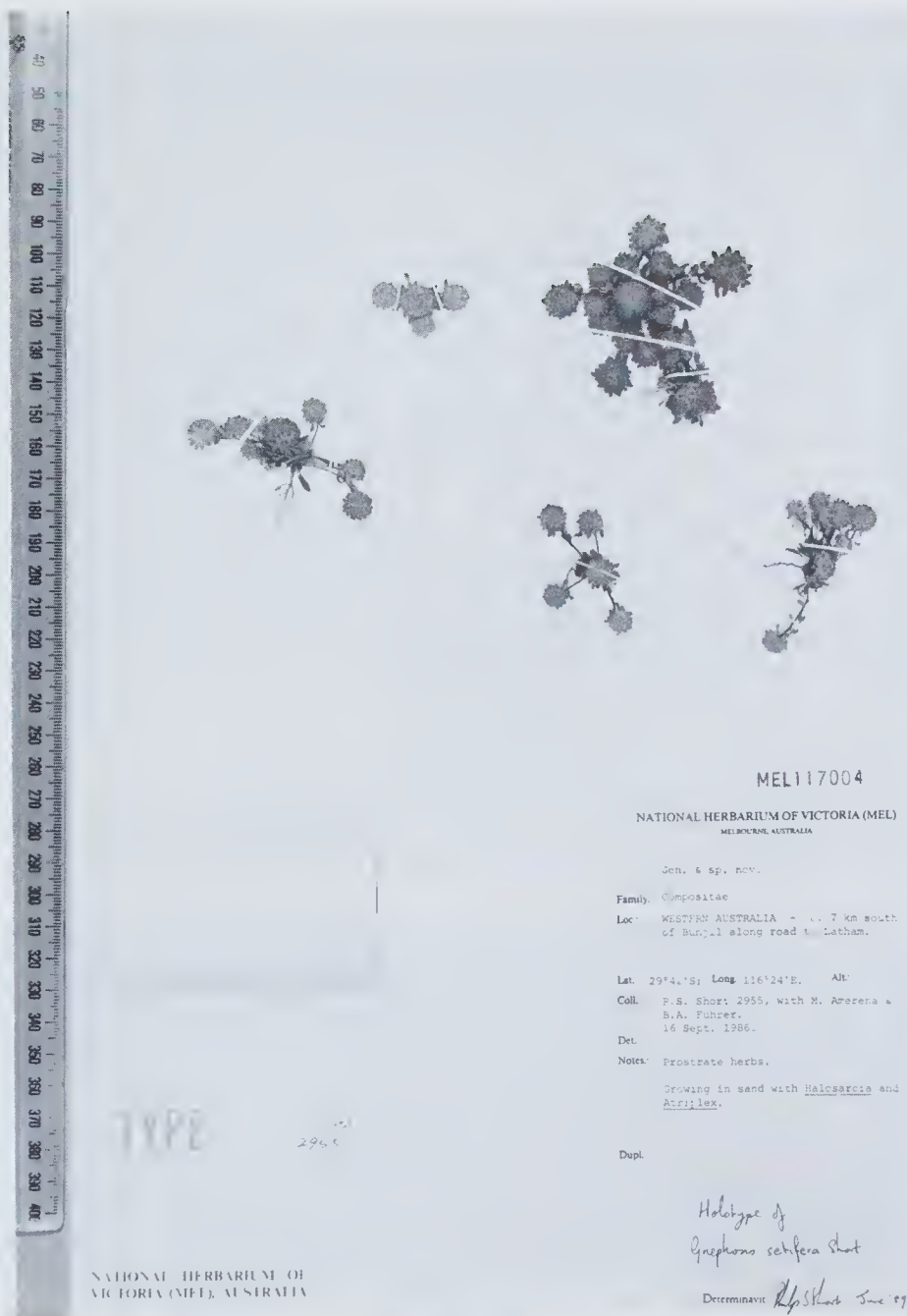


Fig. 2. Holotype sheet of *Gnephosis setifera* (Short 2955 et al.).

SPECIMENS EXAMINED:

Western Australia—On the road from Perenjori to White Wells Farm, 1 km E of Mongers L. 19.ix.1987, *Bergqvist* 040 (MEL, PERTH n.v., S n.v.); 7.2 km from Bunjil along road to Latham. 13.xi.1983, *Haegi* 2663 & *Short* (MEL); c. 7.3 km S of Bunjil. 18.ix.1977, *Short* 582 (AD, MEL); 5 km S of Morowa along road to Perenjori. 16.ix.1986, *Short* 2956, *Amerena & Fuhrer* (MEL, PERTH).

Millotia Cass.

Following the examination of the fruit anatomy and morphology of species of *Millotia*, *Scyphocoronis* and *Toxanthes* it was suggested (Short *et al.* 1989) that, unless considerable emphasis was placed on differences in fruit vestiture, there was little to support the contention of Schodde (1963) that the three genera be maintained. Schodde had already noted that the as then undescribed species, *S. incurva*, had the habit, indumentum and involucre of *Toxanthes*, the alternate leaves, free bracts, peduncles and floret form found in two species of *Millotia*, and the apical cup of *Scyphocoronis*. Accordingly *Scyphocoronis* and *Toxanthes* are herein reduced to synonymy under *Millotia*. New combinations are made and a new species, *M. steetziana*, is described.

Some past workers have obviously felt that the distinctive hollow, cup-like apex of the fruit justified the recognition of the genus *Scyphocoronis*. It certainly is a unique feature within Australian members of the Inuleae (*sensu* Merxmüller *et al.* 1978), but, the upper part of the fruit, whether it is beak-like, dilated at the apex, or cup-like, is always formed from a layer of sclerenchyma which is a continuation of the same layer of tissue surrounding the seed (Short *et al.* 1989). Thus, the unique feature is not only a single character difference but cannot be regarded as a major difference, merely an easily recognizable one. The relegation of *Scyphocoronis*, and indeed *Toxanthes*, to infrageneric rank also seems unwarranted.

The genus *Millotia* is readily differentiated from other Australian inuloid genera by the uniseriate involucre which is composed of bracts that are predominantly herbaceous. Other distinctive features, which at least in this combination are absent from other genera, include the elongated fruit, the often curved corolla tube, and the conical or subulate tips of the style branches.

NEW COMBINATIONS AND SYNONYMS IN MILLOTIA:

Millotia Cass., Ann. Sci. Nat. 17: 31, 416 (1829). T: *M. tenuifolia* Cass.

Toxanthes Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1):176 (27 March 1851). T: *T. perpusilla* Turcz.

Scyphocoronis A. Gray, Ic. Pl. 9, t. 854 (Apr.-Dec. 1851). T: *S. viscosa* A. Gray.

Anthocerastes A. Gray, Hook. J. Bot. Kew Gard. Misc. 4:225 (1852). T: *A. drummondii* A. Gray.

Millotia incurva (D. A. Cooke) P. S. Short, comb. nov.

BASIONYM: *Scyphocoronis incurva* D. A. Cooke, J. Adelaide Bot. Gard. 7:284 (1985).

Millotia major (Turcz.) P. S. Short, comb. nov.

BASIONYM: *Toxanthes major* Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2):64 (Aug.-Oct. 1851).—*Scyphocoronis major* (Turcz.) Druce, Bot. Soc. Exch. Club Brit. Isles 1916:646 (1917).

Scyphocoronis viscosa A. Gray, Ic. Pl. 9, t. 854 (Apr.-Dec. 1851).

Stafleu & Cowan (1979) cite the publication date of plates 801-888 of *Ic. Pl.* as April to December 1851, suggesting that plate 854 was published after August-October, the 'established' publication date of *T. major* in *Bull. Soc. Imp. Naturalistes Moscou* (Marchant 1990).

Millotia muelleri (Sond.) P. S. Short, comb. nov.

BASIONYM: *Anthocerastes muelleri* Sond., Linnaea 25: 480 (1853).—*Toxanthes muelleri* (Sond.) Benth., Fl. Austral. 3:592 (1867).

Millotia perpusilla (Turcz.) P. S. Short, comb. nov.

BASIONYM: *Toxanthes perpusilla* Turcz., Bull. Soc. Imp. Naturalistes Moscou

24(1):177 (27 March 1851).—*Anthocerastes drummondii* A. Gray, Hook. J. Bot. Kew Gard. Misc. 4:226 (Aug. 1852).

For other species of *Millotia* see Schodde (1963, 1968). Note that the name *Millotia cassini* Schodde ex Turner is illegitimate, having been used by Turner (1970), instead of the name *M. inopinata* Schodde, when publishing records of chromosome number determinations.

Millotia steetziana* P. S. Short, *sp. nov.

Herba annua; caulis simplex vel e nodis basalibus ramificans; axes maiores ascendentes usque erecti, c. 1.5–3.5 cm longi, pilis glandulosis. *Folia* ad basem opposita, superiora alterna, lanceolata usque linearia, 3–13 mm longa, 0.25–1 mm lata, erecta, integra, vix mucronata, pilis glandulosis. *Capitula* homogama, terminalia, solitaria. *Bractee* 5–8, uniseriatae, liberae, ellipticae usque anguste ellipticae, 3–3.5 mm longae, 0.7–1 mm latae, praecipue herbaceae sed marginibus et apicibus hyalinis, pilos glandulosos terentes. *Flosculi* 9–31; corolla tubularis, alba; tubos 1.5–2.2 mm longos, pilis glandulosis, lobis 5. *Stamina* 5; antherae 0.79–0.95 mm longae, sporangiis 0.59–0.7 mm longis; appendice terminali triangulari, 0.18–0.25 mm longiba, *pollinis granis* c. 260–320. *Rami styli* apicibus conicis penicillatis. *Cypselae* cylindricae, rostratae, 3.4–4.6 mm longae, 0.2–0.3 mm diametro, papillatae, atrofuscae; rostrum curvum, apice dilatato. *Pappus* absens.

HOLOTYPE: Western Australia, Western edge of Lake King, c. 33° 05'S, 119° 31'E. 11.ix.1982, Short 1685 (MEL 621024). ISOTYPE: AD, K, PERTH.

Annual herb; stem simple or forming major branches at basal nodes; major axes ascending to erect, c. 1.5–3.5 cm long, glandular-pubescent. *Leaves* with the lowermost pair(s) opposite, upper leaves alternate, lanceolate to linear, 3–13 mm long, 0.25–1 mm wide, erect, entire, barely mucronate, glandular pubescent. *Capitula* homogamous, terminal, solitary. *Capitular bracts* 5–8, uniseriate, free, elliptic to narrowly elliptic, 3–3.5 mm long, 0.7–1 mm wide, mainly herbaceous but with the margins and apex hyaline, glandular pubescent. *Florets* 9–31; corolla tubular, white, tube 1.5–2.2 mm long, with glandular hairs; lobes 5. *Stamens* 5; anthers 0.79–0.95 mm long, the microsporangia 0.59–0.7 mm long, the apical appendage 0.18–0.25 mm long. *Pollen grains* c. 260–320 per anther. *Style* apices conical, penicillate. *Cypselas* cylindrical, beaked, 3.3–4.6 mm long, 0.2–0.3 mm diam., papillate, dark brown; beak curved, dilated at the apex. *Pappus* absent. (Fig. 3)

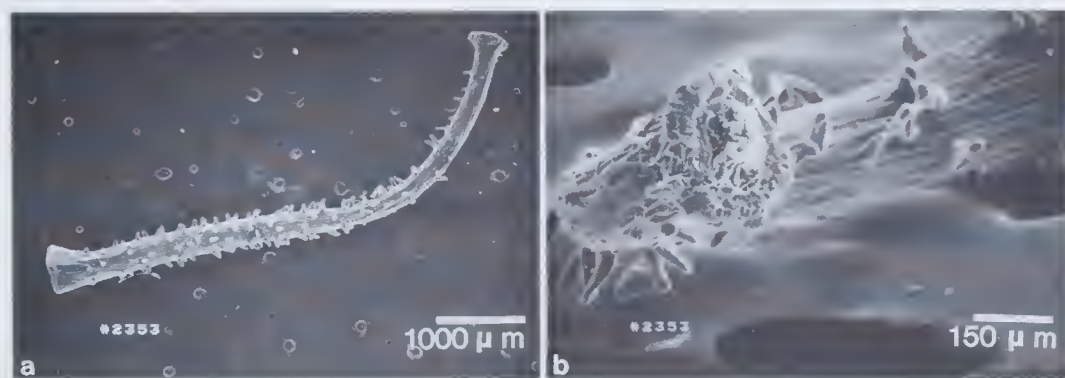


Fig. 3. Fruit of *Millotia steetziana* (Short 2353). a—entire fruit. b—apex.

DISTRIBUTION:

Only known from the western edge of Lake King, Western Australia.

ECOLOGY & REPRODUCTIVE BIOLOGY:

The species has only been found growing in white, probably somewhat saline sand, under *Melaleuca* and *Eucalyptus* on the edge of Lake King.

An average pollen:ovule ratio of 1,460 (determined from 5 florets of Short 1685) suggests that it commonly cross-pollinates.

NOTES:

1. The specific epithet commemorates the Hamburg botanist Joachim Steetz (1804-1862) (Short & Sinkora 1989) who first described a large number of Australian plants, including many in the Asteraceae.

2. The species is only known to me from the type locality and therefore should be accorded the conservation status '1K' under the formula of Leigh *et al.* (1984). It is locally common.

3. The closest relative of *M. steetziana* is probably *M. muelleri*, which differs by a 3-5 lobed corolla tube and an average pollen:ovule ratio of only 83.5 (Short 1981). *M. steetziana* is also very similar in general appearance to *M. major* but that species has fruit with a cup-like apex, a 4-5 lobed corolla tube, and also a low P/O, with determinations of 100 and 116 from two florets of Short 1736.

SPECIMENS EXAMINED:

Western Australia—Lake King, 10.xi.1983, Short 2353 & Haegi (MEL); Lake King, 7.ix.1986, Short 2748, Amerena & Fuhrer (AD, PERTH).

Tietkensia P. S. Short, *gen nov.*

Herba annua; plerumque quaeque planta glomerulus unus rosula foliorum erectorum, raro ramificans. *Folia* sessilia, integra, spatulata, marginibus basalibus alatis, tomentosa. *Glomeruli* transverse ellipsoidei usque lenticulares; involucrum generale absens; receptaculum multum ramosum, pilis longis. *Capitula* c. 5-50. *Bractee* intra capitula c. 6-8, uniseriales, ellipticae vel ovatae; costae latae, indistinctae, viridulae vel purpuracentes, paginis exterioribus pilis longis; apices et margines hyalini, marginibus distalibus laciniatis. *Paleae* bracteis intra capitula similes. *Receptaculum* partiale glabrum. *Flosculi* c. 30-100, praecipue hermaphroditi sed 2-5 extremi feminei. *Flosculi feminei* filiformes; corolla flava, 3 vel 4-lobata; rami styli truncati. *Flosculi hermaphroditi* tubulares; corolla 5-lobata, flava vel interdum purpurascens; rami styli truncati. *Stamina* 5; antherae ad basem caudatae, ad apicem appendicibus sterilibus. *Cypselae* homomorphae, obovoideae, carpodium absens. *Pappus* absens.

TYPUS: *T. corrickiae*

Annual herb usually consisting of a compound head (rarely a single capitulum) surrounded by a basal rosette of erect leaves, rarely with a single major axis (c. 1 cm long) which branches from a basal node and terminates in a compound head. *Leaves* sessile, entire, spatulate but with wing-like margins (c. the length of the compound head) at the base, tomentose. *Compound heads* usually present, transversely elliptic to lenticular; bracts subtending compound heads absent; general receptacle much branched and enveloped with long hairs. *Capitula* c. 5-50 per compound head; capitular bracts c. 6-8, in a single whorl, elliptic or ovate; midrib broad, ill-defined, yellow-green to green or brownish purple, outer surface with long hairs; apex and margins hyaline, the distal margins ciliate. *Paleae* resembling the capitular bracts. *Partial receptacle* oblong, glabrous. *Florets* c. 30-100, mainly bisexual but c. 2-5 outermost ones female. *Female florets* filiform; corolla yellow, minutely 3 or 4-lobed. *Style* branches truncate and ? with short sweeping hairs. *Bisexual florets* tubular; corolla 5-lobed, yellow or sometimes purplish; style branches truncate and with short sweeping hairs, ? without a distinct stylophore and with a basal annulus; stamens 5; anthers caudate and with a sterile apical appendage; endothelial tissue polarized; filament collar straight in outline and composed of uniform cells and basally not thicker than the filament. *Cypselas* homomorphic, obovoid, mainly brownish-purple and covered with minute myxogenic cells but with a longitudinal, yellow-brown portion devoid of myogenic cells developed on one surface; carpodium absent. *Pappus* absent.

DISTRIBUTION (Fig. 4):

This monotypic genus occurs in central and central-western Australia between c. 25° S and 29° S and c. 120° E and 131° E but excluding the sand-dune regions of the Gibson and Great Victoria Deserts.

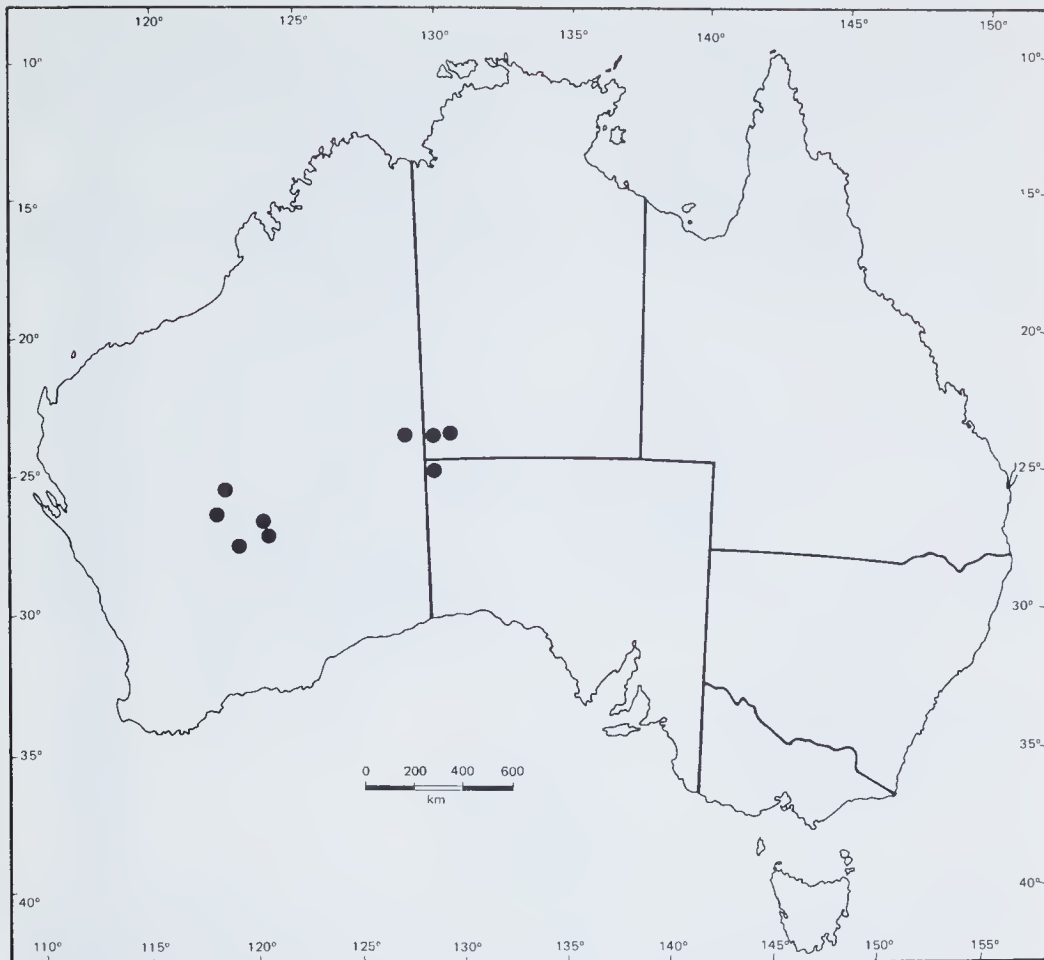


Fig. 4. Distribution of *Tietkensia corrickiae*.

NOTES:

1. The name *Tietkensia* commemorates the central Australian explorer William Henry Tietkens (1844–1933). He accompanied Giles on two expeditions and was leader of the 1889 Central Australian Exploring and Prospecting Association's Expedition. The latter expedition added much geographical detail to the maps of the day (Feeken, Feeken & Spate 1970). Tietkens collected plant specimens for Mueller in Melbourne and Ralph Tate in Adelaide. Their comments (Mueller & Tate 1890) on the collection of 250 species gathered in 1889 were not particularly favourable but none the less they described eight new species from material obtained during this expedition and managed to record an additional 18 species for the Flora of Extra-tropical South Australia.

2. The habit of *T. corrickiae* and the presence of receptacular bracts suggests that this genus has affinities with *Chthonocephalus* Steetz and, as an unnamed species, I have previously referred it to this genus (Short 1981). It is readily differentiated from *Chthonocephalus* by the presence of female florets, not just bisexual disc florets, the paleae which are morphologically similar, not dissimilar, to the capitular bracts, the much branched general receptacle, and the fruit morphology.

Tietkensia corrickiae* P. S. Short, *sp. nov.

Herba annua; plerumque quaeque planta glomerulus unus rosula c. 10–30 foliorum erectorum, raro ramo laterali c. 1 cm longo. *Folia* spatulata, c. 1.5–6 cm longa, 0.2–0.7 cm lata, tomentosa.

Glomeruli transverse ellipsoidei usque lenticulares, c. 0.5 cm longa, 1–4.5 cm diametro. *Capitula* c. 5–50. *Bracteae intra capitula* c. 6–8, ellipticae vel ovatae, c. 3.2–3.8 mm longae, c. 1.4–1.8 mm latae. *Flosculi* c. 30–100 *Flosculi feminei* filiformes; corolla flava, 3 vel 4-lobata, tubo c. 1.9–2.1 mm longo. *Pappus* carens. *Flosculi hermaphroditi* tubulares; corolla 5-lobata, flava vel interdum purpurascens, tubo 1.8–2.2 mm longo. *Stamina* 5; antherae c. 0.75–0.85 mm longae, sporangiis c. 0.6–0.7 mm longis, appendicibus terminalibus triangularibus, c. 0.15 mm longi. *Cypselae* obovoideae, 0.7–0.8 mm longae, 0.4–0.5 mm diametro. *Pappus* absens.

HOLOTYPE: Northern Territory, Ayers Rock to Docker River road at Irvine River crossing. 25° 04'S, 129° 59'E. Gravelly clay flats with scattered *Acacia aneura*, chenopods and grasses and various other Asteraceae. 25.vii.1988, M. G. Corrick 10415 (MEL 693794). ISOTYPE: K, PERTH.

Annual herb usually consisting of a compound head (rarely a single capitulum) surrounded by a basal rosette of c. 10–30 erect leaves, rarely with a lateral, c. 1 cm long branch. *Leaves* spatulate, c. 1.5–6 cm long, 0.2–0.7 cm wide, tomentose. *Compound heads* transversely elliptic to lenticular, c. 0.5 cm long, 1–4.5 cm diam. *Capitula* c. 5–50. *Capitular bracts* c. 6–8, elliptic or ovate, c. 3.2–3.8 mm long, c. 1.4–1.8 mm wide. *Florets* c. 30–100. *Female florets* filiform; corolla yellow, 3 or 4-lobed, tube c. 1.9–2.1 mm long. *Bisexual florets* tubular; corolla 5-lobed, yellow or sometimes purplish, tube 1.8–2.2 mm long. *Stamens* 5; anthers 0.75–0.85 mm long; microsporangia 0.6–0.7 mm long; apical appendages triangular, c. 0.15 mm long. *Cypselas* obovoid, 0.7–0.8 mm long, 0.4–0.5 mm diam.; pappus absent. (Fig. 5)

DISTRIBUTION (Fig. 4):

See generic treatment.

ECOLOGY & REPRODUCTIVE BIOLOGY:

Collectors' notes about the habitat include: 'in red clayey loam, mulga scrub', 'in slightly silty sand, creek flood out. Ironwood, annual grassland', '*Acacia aneura*-*Danthonia* community' and 'flats beside rocky outcrop, sandstone sandy soil'.

The species is gynomonoecious. The percentage of female florets in a capitulum is quite variable, even within a single plant, e.g. in Whibley 6785, within which five capitula were examined, the number of female florets ranged from two to five per capitulum but this represented a range of 2.1–13% of the total number of florets. Pollen-ovule ratios have not been accurately determined but a single bisexual floret from Chinnock 502 was found to contain 2,204 pollen grains, suggesting an average P/O of c. 2,000 for the species, a figure suggesting that the species commonly cross-pollinates.

NOTES:

1. The specific epithet honours Mrs Margaret Corrick, now retired but formerly employed as a technical officer at MEL (Coles 1989). Margaret has collected a number of composites for me during the last few years, often when she has been on holiday, and the holotype collection was gathered after her retirement. Her efforts are greatly appreciated.

SELECTED SPECIMENS EXAMINED (Total 16):

Western Australia—60 miles S of Wiluna, 1931, Blackall 316 (PERTH); Giles, Rawlinson Range, 8.vii.1958, Hill & Lothian 906 (AD).

Northern Territory—2.6 km W Irvine Creek, 25.viii.1973, Chinnock 502 (AD, DNA); Armstrong Creek, 25.viii.1973, Latz 4143 (DNA).

South Australia—Plain between Tomkinson and Mann Ranges, 5.ix.1978, Stove 457 (AD); Tomkinson Ranges, 5.ix.1978, Whibley 6785 (AD).

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TWO NEW SPECIES OF CALLISTEMON R.Br. (MYRTACEAE)

by

P. F. LUMLEY AND R. D. SPENCER*

ABSTRACT

Lumley, P. F. and Spencer, R. D. Two new species of *Callistemon* R.Br. (Myrtaceae). *Muelleria* 7(2): 253-257—The new species, *Callistemon pungens* from New South Wales and *Callistemon recurvus*, from North Queensland are described and illustrated and notes on their distribution, habitat and diagnostic characters are given.

TAXONOMY

Callistemon pungens P. F. Lumley *et* R. D. Spencer, *sp. nov.*

Frutex vel *arbor* parva 2-5 m alta. *Ramuli* rigidi. *Surculi juvenes* primo purpurei viridescens sericei. *Cortex* leviter decorticans, murinus. *Folia* petiolo torto 1-2 mm longo, rigida anguste elliptica vel oblanceolata, 20-30 mm longa, 3.5-5 mm lata, contracta in apicum acuminatum mucrone pungente 1-2 mm longo, costa et venis intramarginalibus leviter prominentibus, glandulis multis, parvis. *Conflorescentia* non frondosa, (40-)50-60(-80) mm longa, 35-45 mm lata, axe pubescenti. *Bracteae* caducae, anguste vel late lanceolatae, striatae, ferrugineae. *Bracteolae* non visae. *Perigynium* 3 mm longum, 2.5 mm latum, pubescens. *Sepala* 5, semicircularia 2 mm lata, membranacea, pubescentia. *Petala* 5, perlate spatulata, 3 mm longa, 3 mm lata, supra glabrata, viridia. *Stamina* libra c. 30, 12-14 mm longa, purpurea, antheris c. 0.8 mm longis, purpureis. *Ovarium* triloculare, supra tomentosum. *Stylus* plerumque stamina superans, purpurea. *Fructi* persistentes truncato-globosi, post annum primum c. 4-5 mm longi, 5-7 mm lati. *Semen* angulare c. 1 mm longum.

TYPUS: New South Wales, Northern Tablelands, c. 0.3 km along road to Armidale from junction with road from the Armidale/Dorrigo Road to Hillgrove, (c. 4 km from Highway). 30° 33'S, 151° 54'E, 21.xi.1983, *P. F. Lumley 1150* (HOLOTYPUS: MEL 650211. ISOTYPI: NE, NSW, CANB).

Shrub or small *tree* 2-5 m tall with rigid branches; new growth sericeous, purple at first, becoming green. *Bark* gradually peeling, grey-brown. *Leaves* 20-30 mm long, 3.5-5 mm wide with a twisted petiole 1-2 mm long; glands many, small; apex acuminate with a pungent mucro 1-2 mm long; midrib and intramarginal veins prominent. *Conflorescence* not frondose, (40-)50-60(-80) mm long, 35-45 mm wide with a pubescent axis. *Bracts* caducous, narrowly to broadly lanceolate, striate, ferruginous. *Bracteoles* not seen. *Perigynium* 3 mm long, 2.5 mm wide, pubescent. *Sepals* 5, semicircular, 2 mm wide, membranous, pubescent. *Petals* 5, broadly spatulate, 3 mm long, 3 mm wide, glabrous above, green. *Stamens* about 30, free, 12-14 mm long, purple; anthers c. 0.8 mm long, purple. *Ovary* trilocular, tomentose above; style usually exceeding stamens, purple. *Fruit* persistent, truncate-globose, 4-5 mm long, 5-7 mm wide after 1 year. *Seed* angular c. 1 mm long. (Fig. 1)

DISTRIBUTION:

New South Wales, Northern Tablelands, Howell; Southern Queensland, Stanthorpe region, near Hillgrove.

ECOLOGY:

In sandy creek beds on granite. Conservation status: although abundant in its few remaining localities, *C. pungens* should be regarded as vulnerable.

REPRESENTATIVE SPECIMENS (total number examined 6):

New South Wales—*Northern Tablelands*: Howell, 1 km along track by side of sandy creek, 22.xi.1983, *P. F. Lumley 1156* (MEL 650074).

Queensland—*Darling Downs*: Severn River, north east of Ballandean where road from Ballandean crosses it, 18.xi.1983, *P. F. Lumley 1113* (MEL 650197).

* Royal Botanic Gardens Melbourne, Birdwood Avenue, South Yarra, Victoria, Australia 3141.



Fig. 1. *Callistemon pungens*. a—flowering twig, $\times 1$. b—fruits, $\times 1$. c—leaf, $\times 3$. All drawn from Holotype.

NOTES:

A very distinctive species characterised by its purple stamens and small, pungent leaves. It appears to have affinities with *C. citrinus* (Curtis) Skeels.

Plants in the horticultural trade as *C. 'Lana'* apparently originated from a single remaining tree of this species on the 'Lana' property west of Uralla. A plant at the RBG Melbourne was received as *C. 'Gilesii'*.

The natural habitat of this species is largely occupied by naturalised species.

Callistemon recurvus R. D. Spencer *et* P. F. Lumley, *sp. nov.*

Callistemon species (Tinaroo). W. R. Elliot & D. L. Jones, *Encycl. Austral. Pl.* 2: 425, plate p. 425 (1982).

Callistemon sp., Tinaroo Bottlebrush. K. A. W. Williams, *Native Pl. Queensland*, ed. 3, 1: 48, plate p. 49 (1984).

Frutex vel *arbor* parva interdum usque ad c. 7 m alta. *Ramuli* interdum pendentes. *Surculi juvenes* rosei viridescentes sericei. *Cortex* in trunco leviter fissuratus, alibi papyraceus cinereus. *Folia* forma et amplitudine variabilia, sessilia vel petiolo usque ad 1 mm longo, anguste oblanceolata, flexibilia et sat tenua, (1-)2-4(-5) cm longa, (2-)3-5(-8) mm lata, pungente mucrone 0.5-1 mm longo; venis prominentibus, venis intramarginalibus relative inconspicuis; margine undulato recurvo; glandulis multis et parvis infra et supra. *Conflorescentia* 3-5(-8) cm longa, (3-)3.5(-4) cm lata; axe pubescens. *Bractaeae* caducae, anguste vel late lanceolatae, striatae, ferrugineae. *Bracteolae* lanceolatae, jam caducae, plus minusve glabrae infra. *Perigynium* c. 3 mm latum, glabratum. *Sepala* 5, c. 1 mm longa, 1.5 mm lata. *Petala* 5, concava, c. 3-4 mm longa, viridia saepe suffusa rosea, marginis ciliatis. *Stamina* libera; filamenta c. 12-15 mm longa, coccinea. *Antherae* aureae c. 0.5 mm longae. *Ovarium* triloculare, tomentosum supra. *Stylus* coccineus, maximam partem aequans stamina. *Stigma* capitatum. *Fructi* globosi vel urceolati c. 4-5 mm longa, 3-5 mm lata, non persistens, orificio constricto. *Semen* angulare, atrobrunneus.

TYPUS: Queensland, Cook. Mt Stewart east of Herberton. On granite, 17° 2'-S, 145° 3'-E, v.1977, *R. Russel s.n.* (HOLOTYPE: BRI 221832).

Shrub to small narrow *tree* to c. 7 m tall but generally much less, with ascending branches; branchlets sometimes pendulous; new growth sericeous, red, soon becoming green. *Bark* fissured on main trunk, pale grey and slightly papery elsewhere. *Leaves* variable in size and shape, even on the same plant, densely distributed, sessile or with short petiole c. 1 mm long; lamina flexible, relatively thin, narrowly oblanceolate, (1-)2-4(-5) cm long, (2-)3-5(-8) mm wide, pungent with a mucro 0.5-1 mm long; midrib and lateral veins distinct on both surfaces but intramarginal veins not evident; margins often slightly recurved and undulate, most marked on dried specimens; small oil glands on both surfaces. *Conflorescence* 3-5(-8) cm long, (3-)3.5(-4) cm wide; axis finely pubescent at first. *Bracts* narrow to broad-lanceolate, striate, reddish brown, often darker at the tip, chartaceous, caducous. *Bracteoles* when present, broadly lanceolate, more or less glabrous on outside, caducous. *Perigynium* c. 3 mm wide, glabrate. *Sepals* 5, semi-persistent, c. 1 mm long, 1.5 mm wide, hairy on the outside, greenish to crimson. *Petals* 5, concave, narrowed at the base, c. 3-4 mm long, 3 mm wide, glabrous, green tinged red; margin ciliate. *Stamens* c. 12-15 mm long; filaments free, slender, crimson; anthers yellow, c. 0.5 mm long. *Ovary* trilocular, tomentose on upper surface at first; style generally equal to or a little longer than the stamens and crimson; stigma capitate. *Fruit* globose to urceolate, 3-5 mm wide, 4-5 mm long, orifice generally constricted, rarely persisting for many years. *Seed* dark brown, angular. (Fig. 2)

DISTRIBUTION:

North Queensland (Cook and North Kennedy Districts). Ranges of the Atherton Tableland.

ECOLOGY:

On rocky montane slopes and gullies where it is often found as an undershrub in open forest in granitic soils along moist soaks. Flowering time: irregular, mostly Aug.-Oct. Conservation status: not under threat.



Fig. 2. *Callistemon recurvus*. a—flowering twig, $\times 1$. b—fruits, $\times 1$. c—leaf, under surface, $\times 4$. All drawn from Holotype.

REPRESENTATIVE SPECIMENS (total number examined c. 10):

Queensland—North Kennedy District: Tully Falls, 14.viii.1957, B. Hyland s.n. (BRI 38745); Cook District: Between Tinaroo Falls and Danbulla . . ., 21.viii.1963, S. T. Blake 22096 (BRI 163056); North Kennedy District: State Forest Reserve 194—Walsh Falls 27.ix.1967, B. Hyland 3962 (BRI 131822).

NOTES:

A distinctive, though variable, species recognised by its densely-distributed oblanceolate leaves, often with recurved and slightly undulate margins: they are often orientated horizontally on the plant. A variant with generally narrower leaves and smaller fruits is found in the northern area of its distribution range on Mt Mulligan (Dupl. J. R. Clarkson 5294, 12.iv.1984, MEL 665390 also QRS, MO, CANB, K, NSW, PERTH, DNA).

Williams (1984) reported that seeds of this species had been collected, propagated and distributed and that the plant was well established in cultivation, having the advantage of often producing more than one flush of flowers in the year. Elliot & Jones (1982) refer to its availability in horticulture as the cultivars 'Tinaroo Dazzler' and 'Tinaroo Falls'.

ACKNOWLEDGEMENTS

We are grateful to the curators of BRI, NSW & NE for the loan of specimens, and to Anita Barley for the illustrations.

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HAEGIELA, A NEW GENUS OF AUSTRALIAN ASTERACEAE (INULEAE: GNAPHALIINAE), WITH NOTES ON THE GENUS *EPALTES* Cass.

by

P. S. SHORT* and PAUL G. WILSON†

ABSTRACT

Short, P. S. and Wilson, Paul G. *Haegiela*, a new genus of Australian Asteraceae (Inuleae: Gnaphaliinae), with notes on the genus *Epaltes* Cass. *Muelleria* 7(2): 259–265 (1990). The monotypic, endemic Australian genus, *Haegiela* P. S. Short & Paul G. Wilson, is described. The new combination *Haegiela tatei* (F. Muell.) P. S. Short & Paul G. Wilson is made, a lectotype is selected, and notes on the distribution, habitat and affinities of the genus are provided. The genus *Epaltes* Cass. is considered not to occur in Australia; an indication is given of the correct placement of those Australian species currently included in it.

INTRODUCTION

Epaltes Cass. is well known to be a heterogeneous taxon (Merxmüller *et al.* 1978) and for some years we have been aware that *E. tatei* F. Muell. must be excluded from the genus. In his original description of *E. tatei*, Mueller (1833, pp. 31–32) noted that he had not ventured 'to exclude this interesting little weed from a generic position in *Epaltes*' although various features warranted the assignation 'to the species sectional rank under the name *Petalopholis*'. The aberrant position of *E. tatei* in the genus was also noted by Leins (1971). With an account of the Asteraceae due for the *Flora of Australia* in the 1990s we take this opportunity to describe the genus.

The study of *E. tatei* required us to examine Australian taxa currently placed in *Epaltes*; these were found to belong to other genera of the Plucheinae.

TAXONOMY

Haegiela P. S. Short *et* Paul G. Wilson, *gen. nov.*

Herba annua, indumentum eglandulosum, arachnoideum pilis basin squamiformibus. *Axes majores* ascendentes usque erecti. *Folia* sessilia, bases versus ad ramos laterales adnata, integra, alterna, ovata ad lanceolata vel obovata, infima opposita. *Ramificatio* monopodialis; capitula solitaria, ut videtur subsessilia et axillaria, heterogama, c. 2–3 mm diametro. *Bractee involucri* c. 15–20, in seriebus tribus ordinatis; bractee exteriores imbricatae, ovatae ad late ovatae vel late ellipticae, scariosae, translucentes, argenteae, quidem marginibus superioribus viliatis, raro bracteo infimo foliiformi; bractee interiores subcartilagineae, teretes, bracteis exterioribus c. 1/2 breviores, interdum apicibus hyalinis ciliatis. *Receptaculum* planum, glabrum. *Flosculi* 36–60. *Flosculi exteriores* filiformi, feminei, 22–49. *Flosculi interiores* hermaphroditi, 7–11; corolla tubulares, versus apicem subercolata; lobi 4, brevissimi, facie interiora papilloso. *Stamina* 4; antherae caudae filamentosae; appendices steriles breviter oblongae, cellulis oblongis (parietibus tenuibus) fabricatis. *Stylus* filiformis, ramis brevissimis, truncatis. *Cypselae* subobovoideae vel ellipsoideae, subpapillatae; carpodium parvum; pericarpium hyalinum testam tenuem conjunctum. *Pappus* carens.

TYPUS: *H. tatei* (F. Muell.) P. S. Short & Paul G. Wilson

Annual herb. Major axes ascending to erect; indumentum eglandular, cobwebby with filamentous, linear, multicellular hairs that become flattened at the base. Branching monopodial, the axis terminating in a capitulum. *Leaves* sessile, towards the base adnate to the lateral branch, entire, ovate to lanceolate or obovate or linear, at least the lower ones opposite and connate. *Capitula* axillary, solitary, subsessile, heterogamous, c. 2–3 mm diam. *Involucral bracts* c. 15–20, in 3 rows, all bracts

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

† Western Australian Herbarium, P.O. Box 104, Como, Western Australia, Australia 6152.

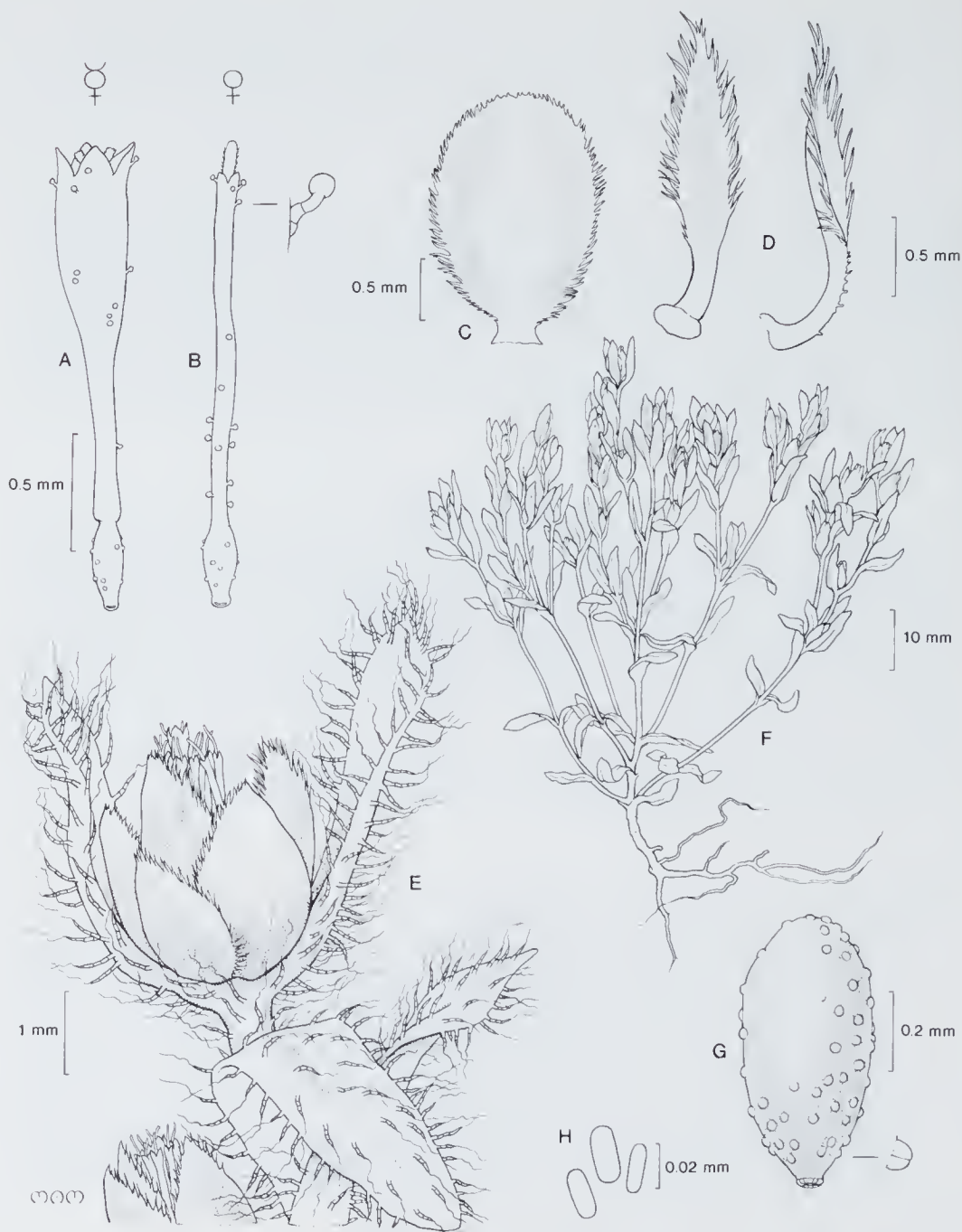


Fig. 1. *Haegiela tatei*. A—Bisexual floret. B—Female floret. C—Outer involucre bract. D—Inner involucre bract (adaxial and lateral views). E—Capitulum and portion of branch. F—Whole plant. G—Cypsela. H—Crystals from testa.

prominently incurved; outer bracts imbricate, ovate to widely ovate or widely elliptic, scarious, silvery translucent, at least the upper margins ciliate; innermost bracts subcartilaginous, terete, with a ciliate, hyaline apex, in all c. 1/3–1/2 length of the outer bracts. *Receptacle* flat, glabrous. *Florets* 36–60, just exceeding the involucre. *Outer florets* female, 22–49; corolla filiform. *Inner florets* bisexual, 7–11; corolla

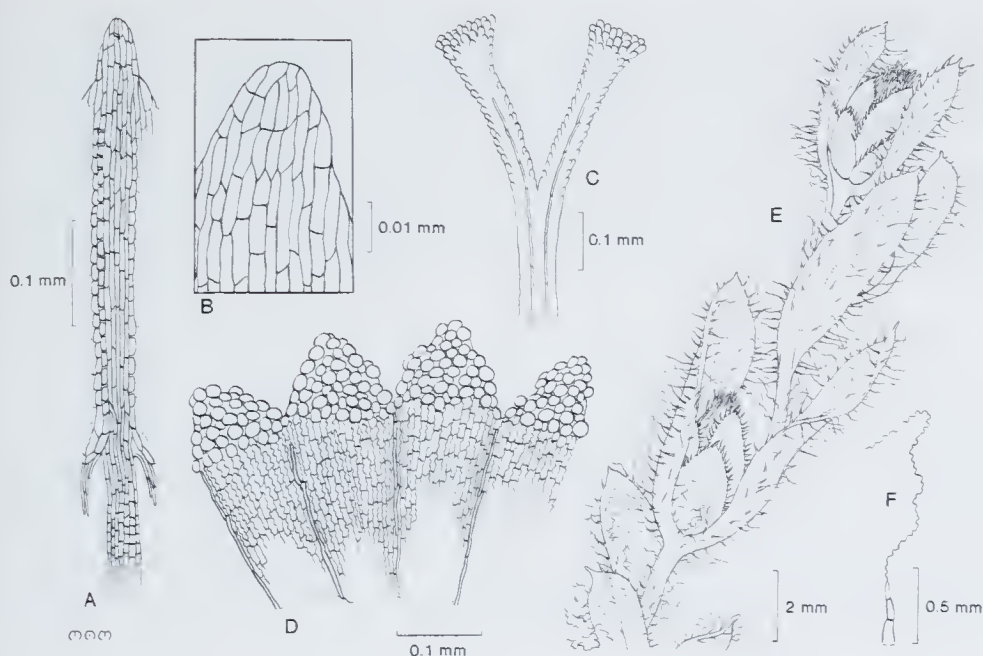


Fig. 2. *Haegiela tatei*. A—Anther. B—Apical appendage of anthers. C—Style branches. D—Corolla apex displayed (adaxial surface). E—Branch. F—Hair from leaf.

cylindrical, sparsely and minutely glandular puberulous. urceolate in throat; lobes 4, very short, papillose within; vascular strands of tube not extending to base of lobes; inner epidermal cells of throat undulate on margin. *Stamens* 4; anthers caudate; tails filamentous; sterile apical appendage short-oblong, delicate with oblong, thin-walled cells; filament collar straight in outline and not wider than the filament. *Style* filiform, branches very short, truncate apically. *Cypselas* obovoid or ellipsoid, minutely papillose with twinned cells; pericarp hyaline with two vascular bundles; testa very thin, intimately fused to pericarp when mature, containing numerous oblong crystals longitudinally arranged; vascular strands not apparent; carpopodium present. *Pappus* annular. (Figs 1, 2)

DISTRIBUTION (Fig. 3):

Monotypic. Widely dispersed in Western Australia, South Australia and western Victoria, south of c. 31° S.

ETYMOLOGY:

The name *Haegiela* is an anagram derived from the names and honouring our colleague at AD, Dr Laurie Haegi.

NOTES:

Burbidge (1963) recognized five species of *Epaltes* as occurring in Australia. The fact that *Epaltes tatei* is markedly dissimilar from the other species placed in the genus was realized by Leins (1971) who noted the truncate style arms and the different pollen structure. He suggested that it be removed from the *Pluchea* group (sensu Merxmüller *et al.* 1977) and indicated that its affinities lay with *Stuartina* Sonder, a member of the Gnaphaliinae (sensu Merxmüller *et al.*). However, although it undoubtedly belongs to the latter subtribe its affinities with *Stuartina* do not appear to be close since this latter genus has cartilaginous involucre bracts, conical corollas with undulate cell margins and glandular papillae on the

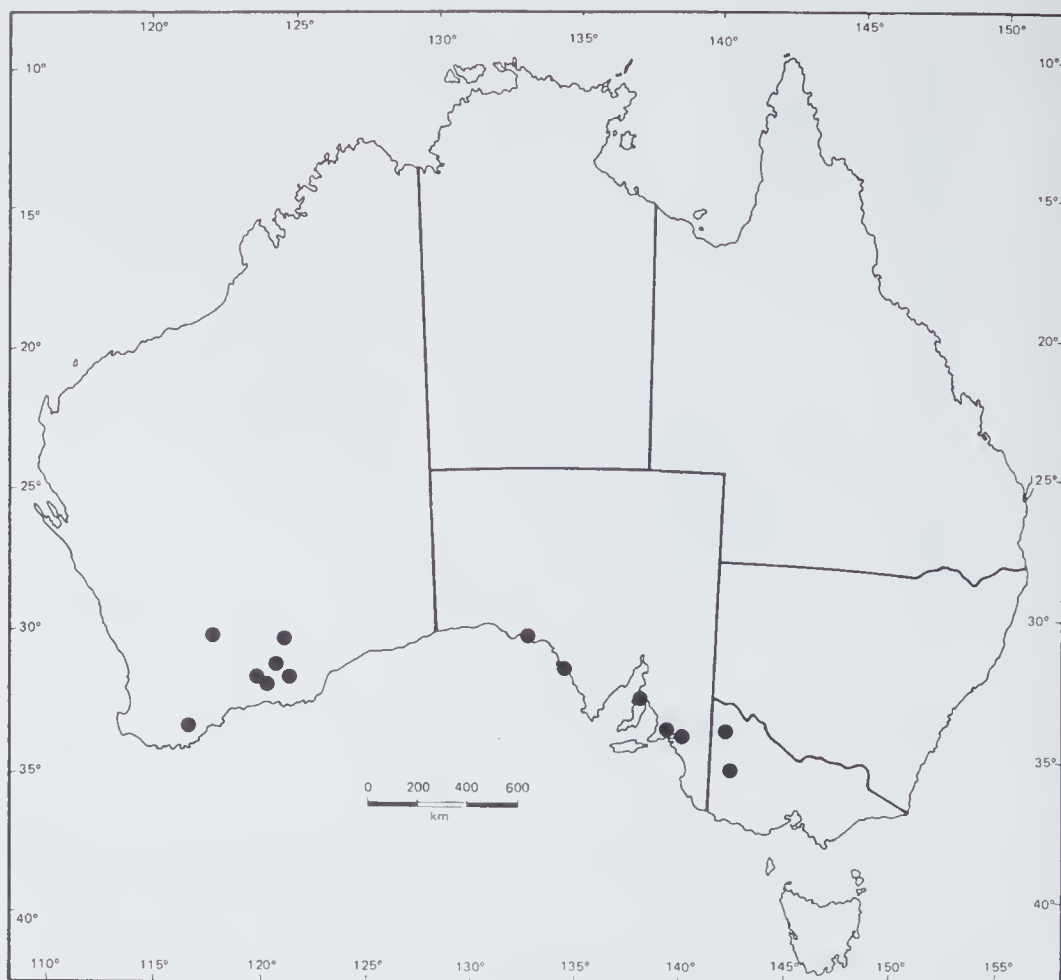


Fig. 3. Distribution of *Haegiela tatei*.

cypsela. The actual affinities of *Haegiela* are with *Triptilodiscus* Turcz., a monotypic genus which is similar to *Haegiela* in habit, branching structure, leaf morphology, capitulum, involucre bracts, and in some details of the florets. It differs from *Haegiela* in the absence of crystals in the testa, and in the presence of a pappus which consists of two or three flat, plumose-ciliate bristles in the bisexual florets but which may be reduced to a ciliate ring in female florets.

Four other Australian species are currently referred to *Epaltes*. Material of *Epaltes cunninghamii* (Hook.) Benth. and *E. australis* Less. has been examined and compared with authentic material of *E. divaricata* (L.) Cass., the type of the genus. All three species have similar corolla, anther, and style structures and undoubtedly belong to the same subtribe, the Pluchinae; however, they differ considerably from each other in habit and in fruit structure. In *E. divaricata* the cypsela is cylindrical, strongly ribbed with rows of large twin-celled papillae between the ribs. In *E. australis* the cypsela is cylindrical with long, duplex setae principally at the base, and scattered, short multicelled, glandular hairs; this species was considered by Merxmüller *et al.* (1976) to belong to the monotypic genus *Sphaeromorphaea* DC. (1838) and, according to Leins (1971), is closely related to *Thespidium* F. Muell. ex Benth. (1867). In *E. cunninghamii* the cypsela is curved, smooth except for a rib on the concave adaxial face beneath which lies the solitary pericarpial vascular strand; this species was placed by Mueller (1861) in his monotypic genus *Ethuliopsis* (syn. *Gynaphanes* Steetz,

1864) as *E. dioica* F. Muell. Both *E. australis* and *E. divaricata* have cypselas that have a pair of opposite pericarpal strands, as is typical in the Asteraceae. It would seem reasonable to place *E. australis* in the genus *Sphaeromorphaea* as *S. australis* (Less.) Kitamura (1936) and *E. cunninghamii* in the genus *Ethuliopsis* where a new combination is required for it.

The two other Australian species placed in *Epaltes* are *E. pleiochaeta* F. Muell., which was placed by Mueller in *Epaltes* sect. *Ethuliopsis* (F. Muell.) F. Muell. (1877), and *E. harrisii* F. Muell. (1880). Neither of these species is known to the authors (MEL material being inaccessible at the time of writing), but their descriptions do not suggest affinity with *Haegiela*.

Haegiela tatei* (F. Muell.) P. S. Short et Paul G. Wilson, *comb. nov.

BASIONYM: *Epaltes tatei* F. Muell., Trans. & Proc. Roy. Soc. S. Aust. 6: 31 (Dec. 1883); J. M. Black, Fl. S. Aust. 1st ed. 618 (1929), 2nd ed. 895 (1957); J. H. Willis, Handb. Pl. Vict. 2:699 (1973). TYPE: 'On sandy scrub-lands between Wellington and Mason's Look-Out, at the east side of Lake Alexandrina. (Prof. R. Tate)'; 'from the vicinity of Spencer's Gulf'. LECTOTYPE (here designated): Scrub near Wellington, 2.x.1880. *Tate s.n.* (MEL 1551068 *p.p.*). ISOLECTOTYPES: Sandy scrubland W Wellington Lodge, 2.x.1880. *Tate s.n.* (AD 97624341 *p.p.*); Fowler's Bay and Scrub between Wellington E & Mason's lookout (E of lake Alexandrina), 2.x.1880. (AD 97643080 *p.p.*, *ex herb.* J. M. Black). POSSIBLE LECTOPARATYPE: MEL 1551068 *p.p.* See Notes.

Annual herb. Major axes ascending to erect, c. 2–8 cm long. *Leaves* ovate to lanceolate or obovate or linear, 2.5–6.7 mm long, 0.5–1.9 mm wide, glabrous or cobwebby. *Capitula* c. 2–3 mm diam. *Involucral bracts* c. 15–20, in 3 rows, all bracts prominently incurved; outer bracts ovate to widely ovate or widely elliptic, 2.4–3.5 mm long, 0.8–1.9 mm wide, scarious, silvery translucent, at least the upper margins ciliate; innermost bracts subcartilaginous, terete, with a small ciliate hyaline apex, in all 1–1.5 mm long, c. 0.2 mm wide. *Receptacle* flat, glabrous. *Outer florets*, female, 22–49; corolla c. 1.5 mm long. *Inner florets* bisexual, 7–11; corolla c. 1.5 mm long; lobes 4, minute, papillose within, sparsely glandular puberulous outside. *Stamens* 4; anthers 0.41–0.5 mm; microsporangia 0.31–0.41 mm long; apical appendages triangular, 0.08–0.1 mm long. *Cypselas* obovoid or ellipsoid, 0.5–0.7 mm long, 0.25–0.35 mm diam. *Pappus* absent.

DISTRIBUTION:

See generic treatment.

ECOLOGY & REPRODUCTIVE BIOLOGY:

Apparently restricted to saline habitats, as reflected by the following collectors' notes: '... saline depression. *Halosarcia* sp., *Lawrencia squamata*, *Hydrocotyle medicaginoides*, *Angianthus preissianus*'; 'edge of ... saline depression ... in low shrubland [with] *Halosarcia* sp., *Rhagodia candolleana*, *Frankenia pauciflora*'; 'In higher parts of samphire with *Halosarcia pergranulata*, *H. pruinosa*. Gypseous soil.' and 'Margin of samphire mud flats/salt swamp ... in small patches in sand ... [with] dwarf shrubs of *Frankenia* & *Chenopodiaceae*'.

The inconspicuous habit of the plant, its anther size and a pollen:ovule ratio of c. 56 (determined from a single capitulum with 9 bisexual florets, 31 female florets and a total of 248 pollen grains in the bisexual floret examined) are indicative of self-pollination.

NOTES:

The lectotype sheet contains two labels. One is a standard, blue, herbarium label and has the words 'Entrance of the Murray-River. (1883). 1886 Prof. Tate'. The other, an original label in Tate's hand, has 'Composite. Scrub near Wellington.

Oct. 2, 1880 (*R. Tate*).’ The sheet contains a single specimen directly attached to it, and a fragmentary collection contained in a paper envelope.

At first glance the labels and specimens cannot be unequivocally matched. However, in the original description Mueller refers to a plant ‘with stems numerous from a slender root, not exceeding two inches in height’, a description readily applicable to the entire specimen attached to the sheet, but not to the fragmentary collection. Furthermore, this same specimen, which is selected as the lectotype, is most likely to be associated with the original label in Tate’s hand. The label has two parallel slits which at one stage presumably accommodated the specimen. The view that Mueller examined only a single specimen is also supported by a letter (dated 19 Feb. 1883, original Barr Smith Library, Uni. of Adelaide, copy at MEL) in which Mueller recorded that ‘Some time ago, dear Prof. Tate, I had made some notes on the curious little Composite, which you collected on 2 Oct. 1880 near Wellington, and of which you sent me a specimen . . .’.

The fragmentary material in the envelope may be a lectoparatype to which the standard, blue, herbarium label refers. However, although the locality data on the label is more or less equatable with that in the protologue, one of the two dates cited, *i.e.* 1886, suggest that the fragmentary collection was gathered after publication of the species name.

The isolectotype sheet AD 97624341 contains two collections, *i.e.* the type material and a collection gathered by A. F. Richards from Fowlers Bay. Both specimens were apparently part of the Tate herbarium. It is difficult to match the labels with the specimens although the isolectotype material seems to consist of a single, much branched plant.

The isolectotype sheet AD 97643080 contains fragmentary material obtained by J. M. Black from the Tate herbarium. It is unclear as to what specimens relate to the Wellington (type) collection.

There is no indication on the sheets that Mueller saw either of the AD isolectotypes.

In the original description Mueller noted that the species had been known to him for many years from specimens gathered near Spencer’s Gulf. Collections with this locality data have not been located at MEL.

SELECTED SPECIMENS EXAMINED (Total c. 35):

Western Australia—5 km S of Peak Eleanora, 8.xi.1979, *Newbey 6347* (PERTH); 5.5 km E of Yellowdine, 4.xi.1983, *Haegi 2549 & Short* (MEL); 47 km E of Cranbrook along Salt River Road, 10.xi.1986, *Paul G. Wilson 12361* (PERTH).

South Australia—12.5 km NE of Meningie, 30.x.1986, *Davies et al 67* (AD); 19 km SSE of Wellington, 31.x.1986, *Davies et al 72* (AD); Point Sinclair, 16.ix.1971, *Eichler 21372* (AD).

Victoria—Mitre Flora & Fauna Reserve, 11.xi.1986, *Beaughtole 80521* (MEL); Pink Lakes State Park, 20.x.1983, *Browne 189* (MEL).

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THE *POMADERRIS ORARIA* F. MUELL. COMPLEX IN AUSTRALIA.

by

N. G. WALSH*

ABSTRACT

Walsh, N. G. The *Pomaderris oraria* F. Muell. complex in Australia. *Muelleria* 7(2): 267–287 (1990).—The *Pomaderris oraria* complex is defined to include *P. oraria*, *P. paniculosa*, *P. flabellare*, *P. halmaturina* and a new species *P. oblongifolia*. Three new subspecies are described: *P. oraria* subsp. *calcicola* from Victoria, *P. paniculosa* subsp. *paralia* from Western Australia, South Australia, Victoria and Tasmania, and *P. halmaturina* subsp. *continentis* from South Australia and Victoria.

INTRODUCTION

Although some confusion has existed over the application of the name *P. oraria* in the past, most recent authors (e.g. Jessop 1986; Willis 1973; Curtis 1956) have applied the name to a widespread species of southern coasts, and plants of similar appearance from a number of inland, semi-arid sites. Inspection of material labelled *P. oraria* in Australian herbaria has indicated the existence of five distinct taxa. These taxa and other closely related species, comprising a distinctive group within the genus (here referred to as the *P. oraria* complex), are here defined and their distribution and ecology discussed.

DEFINITION OF THE *P. ORARIA* COMPLEX

All taxa within the complex are low to medium shrubs with orbicular to oblong leaves which are invested on the abaxial surface with a dense indumentum of fine stellate hairs, usually overlain with scattered, larger, often rust-coloured stellate hairs. The indumentum of the abaxial surface typically extends around the margin to the adaxial surface, creating a narrow border, a feature which is often used in the field to distinguish members of the *P. oraria* complex from vegetatively similar species such as *P. prunifolia* Cunn. ex Fenzl, *P. betulina* Cunn. and *P. racemosa* Hook. (this feature is however not an infallible guide). The remainder of the adaxial surface varies between taxa from being wholly glabrous to densely hispid with simple or stellate hairs.

The inflorescence is a slender, often interrupted panicle or, by reduction a raceme, containing relatively few, large flowers in comparison to most other members of the genus. The flowers are apetalous, with the outer surface of the sepals and thalamus tube densely covered with a stellate tomentum, and the ovary summit covered by longer stellate hairs. The glabrous inner surface of the sepals is yellow, greenish, sometimes mottled crimson or, occasionally, entirely crimson. The style is divided virtually to the base into three equal, spreading, stigmatic arms.

The most characteristic feature of the group is observed in the development of the ovary after fertilization. In most *Pomaderris* species, the ovary is initially semi-inferior and either remains so or develops upward relative to the rim of the thalamus tube to produce a capsule with at least as much above as below the level of attachment of the (usually deciduous) sepals. In the *P. oraria* complex however, the ovary is initially almost wholly inferior and matures downward relative to the rim of the thalamus tube, and the sepals are persistent.

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

TAXONOMY

APPLICATION OF THE NAME *P. RACEMOSA* Hook.

Reisseck (1858) published, in *Linnaea*, several manuscript names of F. Mueller's from specimens collected by or forwarded to Mueller. Of these *P. oraria* and *P. paniculosa* were later united by Bentham (1863) under the earlier name *P. racemosa* Hooker (1834). The type of *P. racemosa* at BM (*Mr Lawrence 143*, Van Dieman's Land, 1831) is a specimen in late bud, vegetatively resembling some taxa within the *P. oraria* complex, but with an indumentum not quite matching, and, on dissection of a bud, showing the ovary raised conically above the rim of the thalamus tube, and the style not deeply trifold, features precluding the specimen from belonging to *P. oraria* or its allies. The form of *P. racemosa* with coarse, rusty stellate vestiture as exemplified by the type occurs in Tasmania and south Gippsland in Victoria. The commoner form of the species in Victoria however has a finer greenish indumentum on the abaxial leaf surface. This latter form corresponds to *P. subrepanda* F. Muell. ex Reisseck (1858) but the two forms are linked by many intermediates, leaving *P. subrepanda* best recognized as a later synonym of *P. racemosa* (as it is regarded in recent texts).

Prior (and in some cases subsequent) to the names *P. oraria* and *P. paniculosa* being published, Mueller labelled many specimens as *P. racemosa* Hook., some of which he or other botanists later amended. Mueller's concept of *P. racemosa* included only those taxa here regarded as part of the *P. oraria* complex and not those represented by the type of *P. racemosa* (i.e. Mueller's *P. subrepanda*).

P. racemosa is typically a slender riparian shrub to c. 7 m high, with ovate or elliptic leaves mostly 1–2 cm long, occasionally obscurely toothed, glabrous above or sprinkled with simple and/or stellate hairs. The flowers are apetalous, produced in slender terminal and/or axillary panicles, have deciduous sepals (c. 1.5×1 mm), and the ovary prominently raised and finely stellate-tomentose. The mature capsule is globoid, c. 2.5 mm long and largely superior. The seeds are released through a barely differentiated, membranous operculum which covers virtually the entire inner face of each coccus.

P. racemosa occurs in far south-eastern South Australia, southern Victoria and Tasmania.

KEY TO THE TAXA

1. Leaves fan-shaped (broader than long), crenate or toothed along distal margin, up to 9 mm long (Eyre Penins., S. Aust. only) 3. *P. flabellaris*
1. Leaves orbicular, ovate, lanceolate or oblong, mostly longer than 9 mm 2
2. Leaves toothed or sinuate for the greater part, the longest 30 mm or more; sparsely hispid to subglabrous on adaxial surface (Kangaroo Is. and south east S. Aust., and Lower Glenelg region, Vic., only) 3
2. Leaves entire (rarely irregularly crenate) and mostly less than 30 mm long, or if with a few shallow subapical teeth and/or longer than 30 mm then densely hispid on adaxial surface 4
3. Sepals 2–2.5 mm long, c. 1.5 mm wide at base; leaf margins mostly serrate; mainly Kangaroo Is. (three collections from far south-east S. Aust) 4. *P. halmaturina* subsp. *halmaturina*
3. Sepals 1.5–2 mm long, c. 1 mm wide at base; leaf margins mostly sinuate (Extreme south east S. Aust. and the Lower Glenelg R. region of Vic.) 4. *P. halmaturina* subsp. *continentis*
4. Leaves \pm oblong (length:width $>$ c. 3:1), mostly about 3×1 cm (endemic in gorge tract of Snowy R. near Gelantipy, Vic.) 5. *P. oblongifolia*
4. Leaves orbicular to ovate (length:width mostly $<$ 3:1, if ever $>$ 3:1 then leaves much larger than 3×1 cm) 5
5. Largest leaves mostly $<$ 15 mm; flowers mostly in small axillary clusters (from Ravensthorpe area, W. Aust. to central Vic., ? south-west N.S.W., but not Tas.) 2. *P. paniculosa* subsp. *paniculosa*

5. Largest leaves 15 mm long or more; flowers in narrow, interrupted panicles which are usually both axillary and terminal 6
6. Leaves glabrous on adaxial surface (coastal, from near Esperance, W. Aust., to Gippsland, Vic. and Tas.) 2. *P. paniculosa* subsp. *paralia*
6. Leaves hispid or velutinous on adaxial surface 7
7. Leaves broad elliptic (length:width $< 3:2$), often emarginate and with a few subapical teeth; adaxial surface sparsely to moderately densely coarsely hispid; coastal in south-eastern Vic. and north-eastern Tas. 1. *P. oraria* subsp. *oraria*
7. Leaves ovate to narrowly elliptic (length:width mostly $> 3:2$), rounded or subacute at apex; adaxial surface densely hispid to almost velutinous; limestone areas of eastern Vic 1. *P. oraria* subsp. *calcicola*

1. **Pomaderris oraria** F. Muell. ex Reisseck, *Linnaea* 29:268 (1858). LECTOTYPE (here chosen): Tasmania, *s.dat.*, Stuart (MEL 55377).

Shrub to c. 2 m high. *Stipules* subulate, c. 2 mm long, densely stellate tomentose, caducous. *Leaves* alternate, narrowly to broadly elliptic, hispid to subvelutinous above, densely white stellate-tomentose below with larger rusty hairs above the midrib and lateral nerves. *Inflorescence* of axillary and terminal panicles, usually consisting of several, more or less globular clusters of flowers, occasionally reduced to a single cluster, each panicle usually about as long as the subtending leaf. *Flowers* shortly pedicellate, densely stellate tomentose on outer surface; thalamus tube conical; sepals broadly acute; stamens about as long as sepals; style 1–1.5 mm long, deeply trifid; ovary summit densely covered with long stellate hairs. *Capsule* c. 3 mm long; cocci broadly ovate, 2–2.5 mm long, dorsally rounded, the membranous operculum occupying the greater part of the inner face. *Seed* flattened-ellipsoid, 1.5–2 mm long, slightly ridged along the ventral line, pale brown with a small white aril at base.

Pomaderris oraria subsp. *oraria* W. M. Curtis, *Stud. Fl. Tasm.* 1:112 (1956) *pro parte*; J. H. Willis, *Handb. Pl. Vic.* 2:366 (1973) *pro parte*; L. Costermans, *Native Trees and Shrubs SE Aust.* (form a) *pro parte* 216 (1981); *non* Jessop in J. P. Jessop & H. R. Toelken (eds), *Fl. S. Australia* 2:812 (1986).

P. racemosa auctt. *non* Hook. (1834); Benth., *Fl. Austral.* 1:421, 422 (1863) (form a only); Rodway, *Tasm. Fl.* 26 (1903) *pro parte*; Ewart, *Fl. Victoria*, 748 (1931).

Compact, much-branched shrub to c. 1 m high. *Leaves* often emarginate and shallowly toothed toward the apex, mostly $1-3 \times 0.8-2.3$ cm, hispid above with simple or stellate hairs, the nerves deeply impressed. *Flowers* with thalamus tube c. 1.5 mm long; sepals $1.5-2.2 \times 1-1.3$ mm. (Fig. 1)

REPRESENTATIVE SPECIMENS (Total examined 11):

Victoria—Wilsons Promontory, Darby River, at start of track to Tongue Point, $38^{\circ} 59'S$, $146^{\circ} 16'E$, 2.xi.1980, M. G. Corrick 7074 (MEL); Reeves Beach, near western limit of 90-mile Beach, $38^{\circ} 37'S$, $146^{\circ} 55'E$, 14.vi.1986, N. G. Walsh 1600 (CANB, HO, MEL).

Tasmania—NE, (Badger Head), ix.1972, M. Cameron (HO); Big Peppermint Hill, East Coast, $42^{\circ} 01'S$, $148^{\circ} 53'E$, 15.vii.1980, A. Moscal 383 (HO).

DISTRIBUTION AND CONSERVATION STATUS (Fig. 9):

The subspecies is known with certainty only from coastal sites in northern Tasmania (near Badger Head) and south-eastern Victoria on Wilsons Promontory and the western end of the 90-mile Beach. A sterile Tasmanian specimen from Big Peppermint Hill is tentatively referred to this subspecies but the coarsely toothed leaves and tall-forest habitat are atypical.

The subspecies is regarded as rare, with Risk Code 3RCat (Briggs & Leigh, 1989).



Fig. 1. *Pomaderris oraria* subsp. *oraria*. a—flowering twig, $\times 1$. b—flower, $\times 8$. c—upper surface of leaf, $\times 4$. d—lower surface of leaf, $\times 4$. Drawn from Corrick 7074 (MEL 596732).

HABITAT:

In Victoria, the plants occur on pure siliceous sands on secondary dunes 100–500 m from the coast and on shallow sand over granite a few metres above the high water mark. In Tasmania at Badger Head, the population occurs on skeletal soils developed over fine siltstone on clifftops and foredune slopes within c. 100 m of the shore.

The subspecies occurs in coastal scrub vegetation both in Tasmania and on the mainland with associated species including *Banksia integrifolia*, *B. marginata*, *Acacia sophorae*, *Correa alba* and a distinctive coastal form of *Pomaderris apetala*. At Wilsons Promontory, *P. oraria* subsp. *oraria* grows closely with the more widespread coastal *Pomaderris*, *P. paniculosa* subsp. *paralia* (described below), but no intermediates have been observed.

***Pomaderris oraria* subsp. *callicola* N. G. Walsh subsp. nov.**

P. oraria auctt. non F. Muell. ex Reisseck (1858): J. H. Willis, Handb. Pl. Vic. 2:366 (1973) *pro parte*; L. Costermans, Native Trees and Shrubs SE Aust. (form b) 216 (1981).

a subspecie typica foliis longioribusque integris et floribus majoribus et habitatione ab ora differt.

TYPUS: Victoria, Gippsland Lakes, Toorloo Arm (Stony Ck crossing of the Princes Highway), 37° 48'15"S, 148° 02'45"E, 14.i.1987, *D. E. Albrecht 3039*. (HOLOTYPUS: MEL 689186; ISOTYPUS: CBG).

Distinguished from the typical subspecies in the longer (to 7 cm), relatively narrower leaves (length-breadth ratio mostly exceeding 3:2), with entire margins and obtuse (very rarely emarginate) apices, in the generally larger flowers (thalamus tube c. 2 mm long, sepals 2–2.5 × 1.2–1.5 mm) and in the non-coastal habitat. In addition the shrubs tend to be taller, to c. 2 m high and more diffuse, the panicles longer (usually exceeding the subtending leaves), with rather remote clusters of flowers, and the indumentum on the upper leaf surface very densely hispid to subvelutinous. (Fig. 2)

REPRESENTATIVE SPECIMENS (Total examined 32):

Victoria—Marble Gully outside Bindi Station, 25.xi.1970, *K. C. Rogers* (MEL); Cliffs along Buchan River at Buchan, 15.i.1948, *J. H. Willis* (MEL); Murrindal, 19.x.1947, *N. A. Wakefield 2083* (MEL); c. 2 miles NNE of Swan Reach on Bruthen Rd 27.iii.1971, *A. C. Beaglehole 37682* (MEL, NSW); Stokes Cliffs, northern side of Mitchell R., near Bairnsdale, 29.viii.1925, *T. S. Hart* (MEL); Scriveners Rd, 200 m east of Mississippi Ck, 4 km NW of Lakes Entrance, 37° 50'20"S, 147° 57'00"E, 26.viii.1978, *P. K. Gullan 386* & *N. G. Walsh* (MEL).

DISTRIBUTION AND CONSERVATION STATUS (Fig. 9):

P. oraria subsp. *callicola* is apparently confined to eastern Victoria and occurs sporadically in a rough rectangle between Bairnsdale, Orbost, Wulgulmerang and Omeo.

The subspecies is rare with Risk Code 2RCi (Briggs & Leigh, 1989). The population from which the type collection was made has been largely and possibly entirely destroyed through road realignment and bridge building works on the Princes Highway between Lakes Entrance and Nowa Nowa. Elsewhere within the subspecies' range, populations have been lost or severely reduced through clearing for agriculture of favoured limestone country. Populations are contained within the Murrindal Natural Features Zone and the Lakes Entrance-Lake Tyers Coastal Reserve, but only the former is managed as a biological reserve.

HABITAT:

The subspecies is apparently confined to reddish loams and skeletal soils derived from Devonian and Tertiary limestones at sites where the parent material is exposed. On drier sites (e.g. at Buchan, and Marble Creek near Bindi), it is dominant within a characteristic closed shrubland where associated with, e.g. *Bursaria lasiophylla* and *Allocasuarina verticillata*.



Fig. 2. *Pomaderris oraria* subsp. *calcicola*. a—flowering twig, $\times 1$. b—flower, $\times 8$. c—lower surface of leaf, $\times 4$. d—t.s. through leaf, $\times 10$. e—near mature capsule, $\times 6$. f—coccus, ventral face, $\times 12$. g—portion of small-leaved form, $\times 1$. a-d from the holotype; e, f from Hart s.n. (MEL 55459); g from Willis s.n. (MEL 1564143).

NOTES:

Two recently described species [see *Muelleria* 7(1) 1989] of restricted occurrence occur with the *Pomaderris*, viz. *Acacia caerulescens* Maslin & Court at Buchan and Toorloo Arm (type locality of *P. oraria* subsp. *calcicola*), and *Olearia astroloba* Lander & Walsh at Marble Gully near Omeo.

Although in description, the differences between the two subspecies of *P. oraria* may seem trivial, the different appearance of each in the field and their individualistic habitat preferences justifies their separation at least at a subspecific level.

The epithet *calcicola* (= inhabiting limestone or marble) is derived from the subspecies' habitat preference.

2. ***Pomaderris paniculosa*** F. Muell. ex Reisseck, *Linnaea* 29:269 (1858). LECTOTYPE (here chosen): Nov. Holland. meridional., *F. Mueller s.dat.* (W), in part, see notes below.

Shrub to 2.5 (but mostly to c. 1) m high. *Stipules* subulate, c. 2 mm long, densely stellate tomentose, early caducous and often apparently lacking. *Leaves* alternate, rotund, broadly elliptic, ovate or obovate, sometimes shallowly emarginate, rarely obscurely toothed, glabrous or very shortly hispid above with simple or stellate hairs, densely stellate-tomentose below, wholly pale or with larger rusty hairs scattered or above the nerves. Inflorescence of axillary and/or terminal panicles or racemes. *Flowers* shortly pedicellate, densely stellate-tomentose on outer surface; thalamus tube conical; sepals acute; stamens about as long as sepals; anthers elliptic, 0.5–1 mm long; style 0.5–1 mm long, deeply trifid; ovary summit densely covered with long stellate hairs. *Capsule* c. 3 mm long; cocci broadly ovate, 2–2.5 mm long, dorsally rounded, the membranous operculum occupying the greater part of the inner face. *Seed* as for *P. oraria*.

Pomaderris paniculosa* subsp. *paniculosa

Pomaderris oraria auctt. non F. Muell. ex Reisseck (1858): J. H. Willis, *Handb. Pl. Vic.* 2:366 (1973) *pro parte*; Jessop in J. P. Jessop & H. R. Toelken (eds), *Fl. S. Australia* 2:812 (1986) *pro parte*; W. E. Blackall & B. J. Grieve, *How to Know W. Australian Wildflowers* 1&2:331 (1981); S. W. L. Jacobs & J. Pickard, *Pl. New South Wales* (1981).

Pomaderris racemosa auctt. non Hook. (1834): J. M. Black, *Fl. S. Australia* 546 (1952) *pro parte*; Benth., *Fl. Austral.* 1:421, 422 (1863) (form c only); Ewart, *Fl. Victoria*, 748 (1931) *pro parte*.

Leaves generally obovate or elliptic, mostly 8–15 × 6–12 mm, sometimes slightly folded about the midrib, glabrous or very shortly hispid above with simple or stellate hairs, lateral nerves not strongly impressed; Inflorescence of axillary panicles, or more commonly, racemes, about as long as the subtending leaf, often reduced to a single umbellate cluster (new growth occurs mostly terminally on flowering branches). *Flowers* with thalamus tube 1–1.5 mm long; sepals 1.5–2 × 1–1.3 mm. (Fig. 3)

REPRESENTATIVE SPECIMENS (Total examined 268):

Western Australia—Gales Brook, 1863, *Maxwell* (MEL, PERTH); 30 km SE of Ongerup, 23.x.1975, *K. Newbey* 4866, (MEL, PERTH); Ravensthorpe Range, 22.ix.1926, *C. A. Gardner Herb. 1849*, (PERTH); South of Roes Rock, Fitzgerald River Natl Park, 34° 00'S, 119° 25'E, 17.vii.1970, *A. S. George s.n.* (PERTH).

South Australia—Gawler town, xi.1848, *F. Mueller* (MEL); Guichen Bay, ix. 1850, *F. Mueller* (MEL); Cape Donnington, Port Lincoln, *s. dat.*, *Wilhelmi* (MEL); Yorke Peninsula, 1879, *Tepper* 554 (MEL); Northern Yorke Peninsula, Mona Railway Yard c. 5 km W of Bute, 12.x.1966, *B. Copley* 723 (AD, MEL); Kangaroo Is., Kelly Hill Conservation Reserve, 12 km ENE Cape du Couedic, 4.xi.1958, *P. G. Wilson* 712 (AD); Barratts Scrub, 37° 02'S, 140° 16'E, 15.xi.1981, *P. Gibbons* 39 (AD, MEL).

Victoria—Bendigo district, Whipstick, in Mystery Paddock, 11.x.1961, *W. Pery s.n.* (MEL); NW of Lake Albacutya, ix.1887, *C. French* (MEL); Hawkesdale, x.1900, *H. B. Williamson s.n.* (MEL); The Range Flora Reserve, 18 km ENE of Donald, 24.x.1979, *A. C. Beauglehole* 65387 (MEL); Limestone rises, Jeparit, 12.xi.1899, *D'Alton* (MEL); Dimboola, 13.ix.1899, *D'Alton* (MEL); c. 5 miles NNW of Wedderburn, 31.x.1961, *J. H. Willis s.n.*, (MEL).

DISTRIBUTION AND CONSERVATION STATUS (Fig. 9):

In Western Australia, scattered from the Ravensthorpe-Ongerup district eastward to near Esperance, apparently absent from there to about Ceduna in South Australia, thence from the eastern part of the Great Australian Bight near to the coast eastward and inland across to the Victorian Wimmera (where now probably extinct) through to the Bendigo area. Bentham gives 'desert of the Darling and Murray, F. Mueller' but I have not seen this specimen or any others from New South Wales. A specimen in NSW from the Bourke district, collected in 1912 formerly regarded as *P. oraria* (e.g. Cunningham *et al.*, 1982, Jacobs & Pickard, 1981), belongs to a species of *Keraudrenia*, probably *K. integrifolia*. *P. paniculosa* subsp. *paniculosa* is not regarded as being rare or vulnerable in Australia, but has been substantially depleted through much of its range in Victoria.

HABITAT:

Occurs principally in semi-arid areas (annual rainfall c. 500 mm or less), on soils derived from marine sediments (limestone, sandstone) or aeolian sand. The most commonly associated vegetation type is mallee scrub or woodland. Ecological information from labels is scanty but *Eucalyptus viridus*, *E. microcarpa*, and *E. leucoxylon* are given as associated species in Victoria, *E. porosa*, *E. gracilis*, *E. socialis*, *E. cladocalyx* and *E. leucoxylon* in South Australia and *E. eremophila* in Western Australia.

NOTES:

The type sheet at W consists of four small twigs, all of which conform to the typical form of *P. paniculosa* as defined herein. The twig mounted to the left of the sheet (the largest) has numerous flowers and leaves with a fine stellate indumentum on the adaxial surface. The twig to its right has few flowers and leaves with simple hairs adaxially. The two twigs mounted on the right of the sheet are sterile and have leaves which are glabrous adaxially. These four pieces may have been provided by Mueller to represent the range of variation of leaf indumentum states within the species, but as the sheet clearly comprises more than one collection, the larger, flowering specimen on the left of the sheet is here chosen as the lectotype.

The presence or nature of the indumentum on the upper surfaces of the leaves, although generally a useful and often critical feature in distinguishing taxa in Pomaderris, in this subspecies does not appear to correlate with any other discontinuous characters. Forms with either glabrous or hispid leaf upper-surfaces occur together. A sheet at MEL (55467) from near Bendigo, Vic., consists of three flowering twigs, two with entirely glabrous and one with distinctly hispid leaf upper-surfaces with the comment 'all specimens from same shrub'. This seems unlikely, but given the frequent sympatry of both forms, no formal recognition is here bestowed upon them.

Specimens from Western Australia are uniform in having a dense stellate indumentum on the upper leaf-surfaces. Most, but not all, eastern populations are either glabrous or hispid with simple bristles.

In a few coastal sites in South Australia (e.g. near Kingston in the south-east and shores of Spencers Gulf) where mallee scrubs occur along the coast, this and the following subspecies are apparently sympatric or nearly so. A few specimens appear intermediate between the two (due at least in part to the poor quality of those collections), but the great majority can be unambiguously placed.

Pomaderris paniculosa subsp. paralia N. G. Walsh *subsp. nov.*

P. oraria auctt. non F. Muell. ex Reisseck (1858): W. M. Curtis, Stud. Fl. Tasm. 1:112 (1956) *pro parte*; J. H. Willis, Handb. Pl. Vic. 2:366 (1973) *pro parte*; L. Costermans, Shrubs and Trees SE Aust. (form a) 216 (1981) *pro parte*; Jessop in J. P. Jessop & H. R. Toelken (eds), Fl. S. Australia 2:812 (1986) *pro parte*.

Pomaderris racemosa sensu J. M. Black, Fl. S. Australia 546 (1926) *pro parte*; sensu Benth., Fl. Austral. 1:421,422 (1863) (as form b); sensu Ewart, Fl. Vic., 748 (1931) *pro parte*, non Hook.

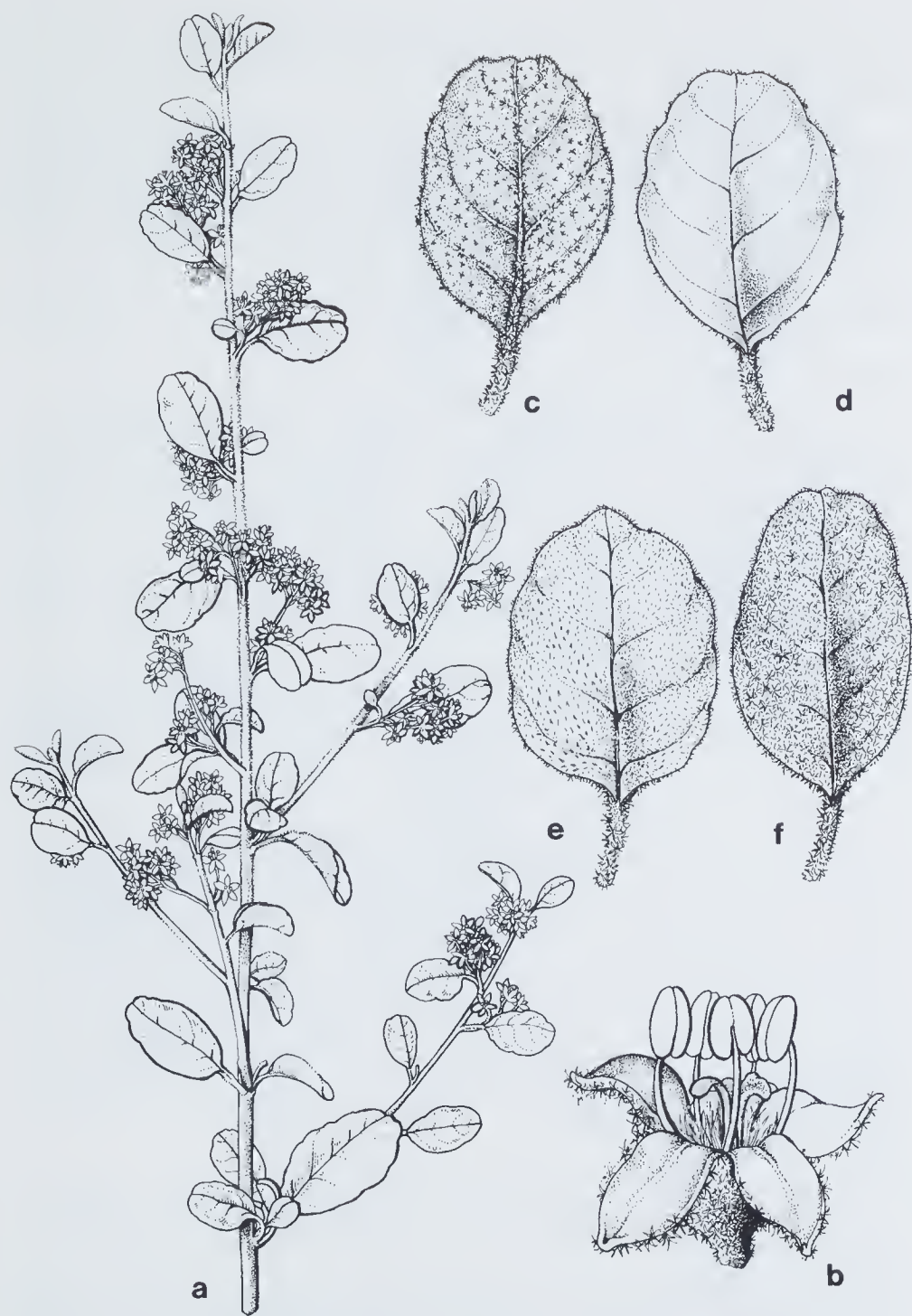


Fig. 3. *Pomaderris paniculosa* subsp. *paniculosa*. a—flowering twig, $\times 1$. b—flower, $\times 10$. c—lower surface of leaf, $\times 4$. d—f leaf from above, $\times 4$; d—glabrous form; e—simple-hispid form; f—stellate-pubescent form. a-d from Perry s.n. (MEL 530738); e from Newbey 4866 (MEL 91863).

a subspecie typica foliis majoribus, ovatis vel ellipticis, pagina supera semper glabro, et paniculis ambabus terminalis et axillaribus, et habitatione ad oram differt.

HOLOTYPE: Victoria, Torquay, ca. 25 km S of Geelong; 23.x.1943, *J. H. Willis s.n.* (MEL 91852).

Differs from the typical subspecies in its generally larger, ovate to elliptic leaves (mostly 15–50 × 10–25 mm) which are consistently glabrous (and shining *in vivo*) on the upper surface, and the inflorescence which generally comprises both axillary and terminal panicles, most of which are longer than the subtending leaves, (new growth is therefore initiated usually below the flowering part of the branches), and in its more strictly coastal habitat.

In addition, the leaves are thicker and firmer than those of *P. paniculosa* subsp. *paniculosa* and the flowers are generally larger (with sepals to 2.5 × 1.5 mm), but this latter character is variable. (Fig. 4)

REPRESENTATIVE SPECIMENS (Total examined 135):

Western Australia—Middle Island, Recherche Archipelago, 25.xi.1950, *J. H. Willis s.n.* (MEL).

South Australia—Yorke Peninsula, Innes National Park, Cape Spencer, 35° 18'S, 136° 53'E, 7.xii.1982, *E. M. Canning 5524 & S. Corbett* (CBG, MEL); Memory Cove, v.1802, *R. Brown s.n.* (MEL, part); Yorke Peninsula, 1880, *Tepper 583* (MEL); Kangaroo Island, 30.vii.1950, *A. Cribb & L. Newton* (MEL); Region 13, south-eastern, 38° 00'S, 140° 57'E, *J. Z. Weber 7788* (AD, MEL); Near Rivoli Bay, x.1848, *F. Mueller* (MEL); Coffin Bay National Park, 34° 43'S, 135° 30'E, 11.xi.1979, *P. C. Heyligers 79095* (AD, CANB).

Victoria—The Lakes National Park, 7 km NE of Golden Beach, 20.xii.1978, *A. C. Beauglehole 62915* (MEL); Australia Felix, *s. dat.*, *F. Mueller* (MEL); Scenic Rd, S of Portland, 38° 21'S, 141° 36'E, *C. & D. Woolcock 1136* (MEL). Cape Schanck Coastal Park, 1.8 km N from Cape Schanck, 9.viii.1981, *N. G. Walsh 587* (MEL). Port Campbell National Park, c. 2.5 km NW from Pt Ronald, 29.v.1984, *N. G. Walsh 1246* (MEL); Wilsons Promontory, Darby River at start of track to Tongue Point, 38° 59'S, 146° 16'E, 2.xi.1980, *M. G. Corrick 7073* (MEL).

Tasmania—Erith Is, Kents Group, 8.xii.1972, *J. S. Whinray 186* (MEL); East Sister Is, Furneaux Group, 30.ix.1972, *J. S. Whinray 269* (MEL); Cape Portland, 1884, *Miss Baudinet* (HO, MEL); Swan Is, -iii.1885, *Judge Dobson* (HO, MEL); Cape Wickham, Kings Is, 1886, *Judge Dobson* (MEL); Port Davies, Flinders Is., 40° 00'S, 147° 52'E, *W. M. Curtis s.n.* (HO); Croppies Point, north of Waterhouse, 40° 51'S, 147° 37'E, 30.vi.1986, *R. J. Peacock s.n.* (MEL).

DISTRIBUTION AND CONSERVATION STATUS (Fig. 9):

P. paniculosa subsp. *paralia* occurs in Western Australia where it is known from a single collection from limestone sea-cliffs of Middle Island in the Recherche Archipelago. The specimen has smaller leaves than typical, but is rather fragmentary. Further material from this area is required to confirm the status of the subspecies in W.A. In South Australia it occurs along the coast from the eastern part of the Great Australian Bight to the Victorian border, and from there along much of the Victorian coast to as far east as the central part of the 90-Mile Beach. In Tasmania it is distributed across the north coast and through the islands of Bass Strait. A specimen purportedly from near Robertson in the northern Mt Lofty Range, S. Aust. (*Amtsberg s.n.*, AD 97244147) appears to be this subspecies, but its occurrence at a locality so far inland is unlikely, suggesting the specimen may be incorrectly labelled. The subspecies is not regarded as rare or threatened.

HABITAT:

Occurs on coastal dunes, cliffs of limestone, sandstone and granite along marine and estuarine shores, occasionally extending inland up to c. 500 m, rarely to c. 10 km as in the Murray Bridge and Mt Gambier (SE South Australia) areas where occurring on old dunes.

Usually included in coastal scrub vegetation with other shrubs e.g. *Leptospermum laevigatum*, *Melaleuca lanceolata*, *Correa alba*, *Kunzea ambigua*, *Lasiopetalum baueri* or in adjacent woodlands dominated by e.g. *Eucalyptus baxteri*.

NOTES:

This is the commonest coastal taxon of the *P. oraria* complex and (probably as a consequence) is the taxon which has been hitherto regarded as 'typical' *P.*



Fig. 4 *Pomaderris paniculosa* subsp. *paralia*. a—flowering twig, $\times 1$. b—flower, $\times 7$. c—mature capsule, $\times 10$. d—lower surface of leaf, $\times 4$. a, b from the holotype; c, d from *Beaulehole* 63525 (MEL 92885).

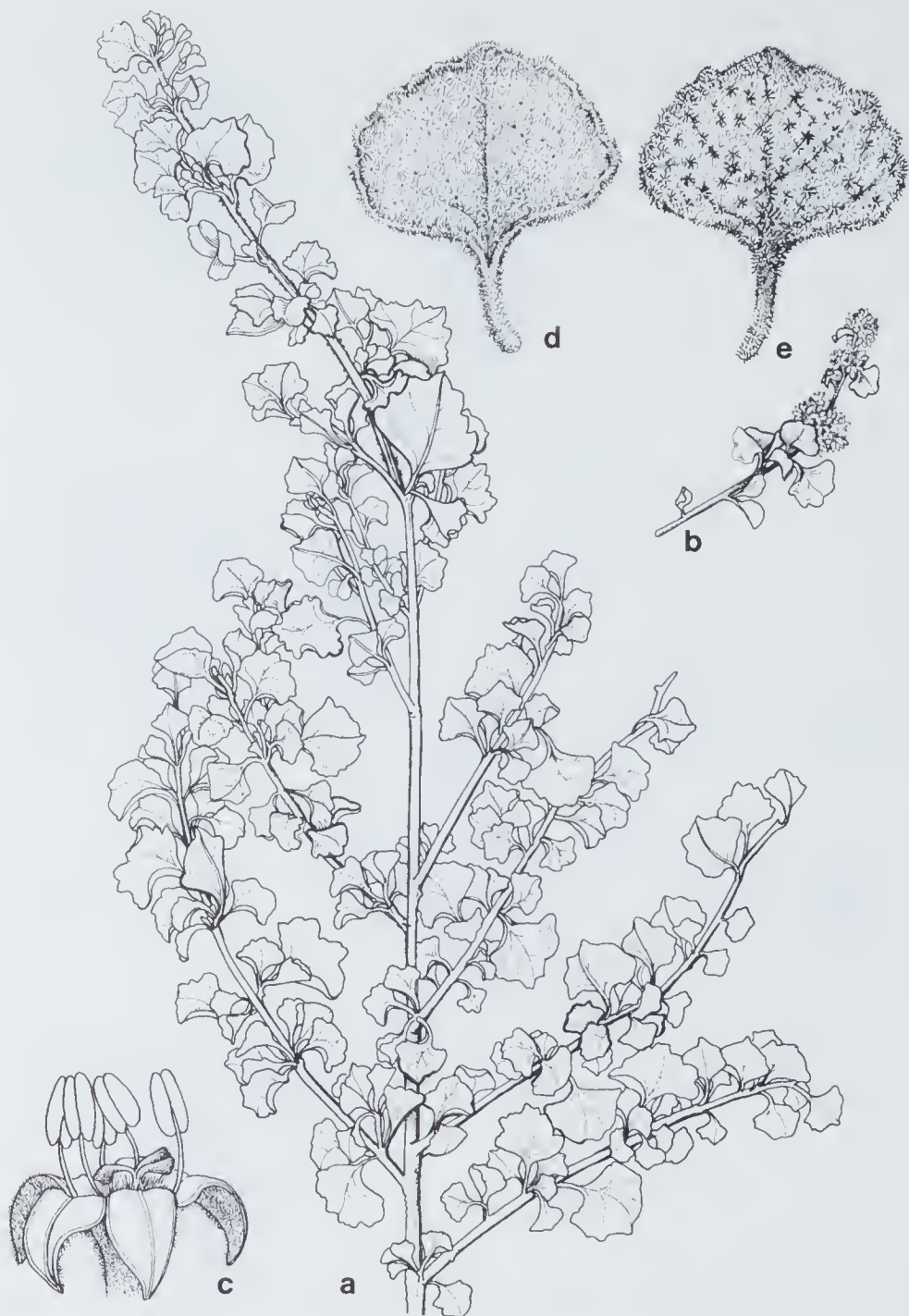


Fig. 5. *Pomaderris flabellaris*. a—Leafy branchlet, $\times 1$. b—flowering twig, $\times 1$. c—flower, $\times 1$. d—upper surface of leaf, $\times 5$. e—lower surface of leaf, $\times 5$. a, d, e from *Filson 1585* (MEL 1011313); b, c from *Brown s.n.* (MEL 55399).

oraria by most botanists and naturalists. It is readily distinguished from *P. oraria sens. strict.* by the glabrous (rather than hispid) leaf upper-surface, and the entire, rarely irregularly crenate or emarginate leaves with less deeply impressed midrib and lateral veins. At Wilsons Promontory both taxa occur together with no apparent intergradation.

At their extremes, the two subspecies of *P. paniculosa* appear to be sufficiently distinct to be regarded as separate species, but the differences become less sharp where the two taxa occur in near proximity in a few areas in S.A. where mallee scrubs occur immediately inland of primary dune vegetation.

Recently *P. paniculosa* subsp. *paralia* has been used in coastal areas as a hardy species for amenity and revegetation planting.

The epithet is derived from Greek, meaning 'by the shore' and is, appropriately, equivalent to the Latin 'oraria'.

3. ***Pomaderris flabellaris*** (F. Muell. ex Reisseck) J. Black, Fl. S. Australia 366 (1926); Jessop in J. P. Jessop & H. R. Toelken (eds), Fl. S. Australia 2:811 (1986).

Trymalium flabellare F. Muell. ex Reisseck, Linnaea 29:281 (1858). LECTOTYPE (here chosen): Boston Point, F. Mueller (MEL 55208). LECTOPARATYPE: Scrub near Meadow Ck, i.1855, *Wilhelmi* (MEL 55205).

A shrub to c. 1 m high. *Stipules* subulate, c. 1.5 mm long, stellate tomentose, early caducous. *Leaves* alternate, flabellate or elliptic, wider than long, the distal margin usually crenate or toothed, flat to almost conduplicate, $4-9 \times 5-14$ mm, densely covered on both surfaces with stellate hairs (or very rarely glabrous above), with some larger, rusty hairs above the veins on the lower surface; venation indistinct above, apparent beneath. *Inflorescence* of short axillary and terminal racemes or slender, few flowered panicles to 2 cm long; *Flowers* shortly pedicellate, densely stellate-tomentose on outer surface; thalamus tube conical, 1-1.5 mm long; sepals acute, $2-2.5 \times 1-1.5$ mm; stamens subequal to sepals; anthers elliptic, c. 1 mm long; style c. 1 mm long, deeply trifid; ovary summit densely covered with long stellate hairs, slightly raised. *Fruits* not known. (Fig. 5)

REPRESENTATIVE SPECIMENS (Total examined 38):

South Australia—Boston Point, Spencers Gulf, s. dat., *Wilhelmi* (MEL); Port Lincoln, 1875, *J. H. Brown s.n.*, (MEL); Port Lincoln, 7.ii.1960, *R. Filson 1585* (MEL); Eyre Peninsula, 2 miles east of Wanilla, xi.1955, *D. J. Smith 221* (MEL); Tod River—Wanilla area, 4.ix.1969, *K. B. Warnes 108* (AD); Hundred of Koppio, north end, 18.ix.1964, *C. R. Alcock C42* (AD).

DISTRIBUTION AND CONSERVATION STATUS (Fig. 9):

P. flabellaris is known only from the Eyre Peninsula, South Australia, particularly in the southern part about Port Lincoln. It is not regarded as rare or threatened by Briggs and Leigh (1988).

HABITAT:

Occurs on shallow soils derived from granite, laterite and quartzite, and is also recorded from sand dunes. Information accompanying specimens is scanty but one collection gives *Eucalyptus cladocalyx* as dominant in the associated vegetation.

NOTES:

In the protologue of *Trymalium flabellare*, Reisseck cites two collections, Boston Point, *F. Mueller* and Meaton Ck, *Wilhelmi*. Of the former, there are two sheets at MEL (both ex Sonder Herb.), both with small sterile twigs and a few fragments in envelopes. The larger specimen of these (with two leafy twigs) has been chosen as the lectotype and the smaller (MEL 55206) an isolectotype. The label, written in Mueller's hand, has: '*Pomaderris (Trymalium) rotundifolia* F. Muell.' (presumably an earlier manuscript name) and below, an addition by Sonder: '*Trymalium flabellare* F. Muell.'

There is also at MEL a Wilhelmi collection labelled: 'Scrub near Meadow Ck, Jan 1855 (MEL 55205). This is almost certainly the 'Meaton Ck' specimen referred to by Reisseck (there appears to be no Meaton Ck in S. Aust.) and is here treated as a lectoparatype.

Black retained the specific epithet *flabellare* when transferring the species from *Trymalium* to *Pomaderris*, but H. J. Eichler (1965) corrected this to *flabellaris*. Of the 38 specimens examined, none were fruiting or had clearly developing ovules. Pollen examined from two specimens in early flower and stained in Alexander's Solution (Alexander, 1969) showed high apparent viability (c. 80–90%). Field studies are required to confirm that *P. flabellaris* is in fact a good breeding species and not an occasional (? female-) sterile hybrid perhaps between *P. paniculosa* and *P. obcordata*, some specimens of which have leaves approaching *P. flabellaris* in shape and indumentum.

4. *Pomaderris halmaturina* J. Black, Trans. R. Soc. S. Australia 49:273 (1925). LECTOTYPE (here chosen): South Australia, Kangaroo Island, Cygnet River, 27.01.1883, Tate, s.n. (AD 97016246 p.p.); ISOLECTOTYPES: AD (97932315 p.p., 07018154 p.p.).

Erect to spreading shrub. Stipules subulate, to c. 7 mm long, densely stellate tomentose, caducous. *Leaves* alternate, narrow elliptic to ovate, margins toothed for the greater part or sinuate, rarely almost entire, 2.5–5.5 × 1.2–2.5 cm, glabrous or sparsely hispid with simple or stellate hairs above, densely stellate tomentose below with larger, rusty hairs above the veins; venation distinct on both surfaces, impressed above. *Inflorescence* of rather sparse axillary and terminal panicles or racemes about as long as the subtending leaf. *Flowers* pedicellate, densely stellate-tomentose on outer surface; thalamus tube conical; sepals acute; stamens slightly shorter than sepals; anthers elliptic, c. 0.5 mm long; style c. 0.5 mm long, deeply trifid; ovary summit covered with stellate hairs. *Capsule* c. 3 mm long; cocci slightly shorter than capsule, the membranous operculum occupying almost all of the inner face. *Seed* as for *P. oraria*.

Pomaderris halmaturina* subsp. *halmaturina

J. Black, Fl. S. Australia 3:366 (1926); Jessop in J. P. Jessop & H. R. Toelken (eds), Fl. S. Australia 2:812 (1986).

Shrub to c. 3 m high. *Leaves* with dentate to biserrate margins, rarely almost entire. *Flowers* with thalamus tube c. 2 mm long; sepals 2–2.5 × c. 1.5 mm. (Fig. 6)

REPRESENTATIVE SPECIMENS (Total examined 36):

South Australia—Kangaroo Island; SE end of island, rich limestone soil, 25.vi.1884, *Tepper 1310* (MEL); Near the small Fr. Water Lagoon of the Three Well (= Cygnet) River, s.dat., *Waterhouse* (MEL); Chapman River, 35° 48'S, 138° 07'E, 11.x.1976, *Spooner 4837* (AD); Hog Bay, 3rd Ck from west of bay, 36° 44'S, 137° 56'E, 29.xi.1983, *R. Davies 474* (AD). Willsons R., Dudley Peninsula, walking track to Mount Flat, 3.11.1984, *G. Jackson 1681* (AD); Rocky R., c. 20 km SSE from Cape Borda, 24.xi.1945, *J. B. Cleland s.n.* (AD). South-east: Toward Carpenter Rocks, c. 16 km from Glencoe Rd crossing, 37° 58'S, 140° 28'E, 3.xi.1981, *N. N. Donner 8508* (AD).

DISTRIBUTION AND CONSERVATION STATUS (Fig. 9):

Almost entirely confined to Kangaroo Island, South Australia and there largely restricted to near-coastal sites on the southern part of the island. Three collections (*Alcock 185*, *Donner 8508*, *Spooner 5486*, all AD) from near Kingston and the Carpenter Rocks area near Mount Gambier in the far south-east, are referable to the typical subspecies and are the only known mainland occurrences.

The subspecies is regarded as endangered (risk code 2E) by Briggs and Leigh (1989).



Fig. 6. *Pomaderris halmaturina* subsp. *halmaturina*. a—flowering twig, $\times 1$. b—flower, $\times 8$. Drawn from Jackson 1718 (MEL 1564144).

HABITAT:

Apparently confined to limestone country, often occurring in scrubby riparian or estuarine vegetation. Commonly associated species were generally not indicated on labels but those listed include *Eucalyptus diversifolia*, *Acacia* and *Leptospermum* (species unknown). The habitat of the mainland populations was not recorded on labels, but *Spooner 5486* notes 'dominant at higher elevations'.

NOTES:

In the protologue, Black cites two syntype collections, viz. Hog Bay and Cygnet River. Three sheets at AD exist with type material; one (AD 97016246) with twigs from both localities has been mounted without indication to the provenance of each but, by reference to the collection dates on the two original labels, it is reasonable to assume that the fruiting twig (collected in January 1883) is the Cygnet River collection and the flowering twig (collected November 1883) is the Hog Bay specimen; another (AD 07018154), is a mixture of fragments of both type collections found in N. A. Wakefield's herbarium (at MEL) and subsequently returned to AD; and the last (AD 97932315), a mixed collection from Cygnet River, of *P. halmaturina* and *P. paniculosa* subsp. *paniculosa* (the latter clearly does not fall within Black's circumscription of *P. halmaturina* and therefore does not comprise syntype material). The specimen mounted on the left side of AD 97016246 is here chosen as the lectotype. Material of *P. halmaturina* from Cygnet River on sheets AD 07018154 and AD 9793215 thus become isoelectotypes and the Hog Bay specimens (AD 97016246 in part, and 07018154 in part) lectoparatypes.

P. halmaturina subsp. *halmaturina* and both subspecies of *P. paniculosa* occur on Kangaroo Island. A specimen from Kelly Hill Conservation Park, E. N. S. Jackson 4493 (AD, MEL) appears intermediate between *P. halmaturina* subsp. *halmaturina* and *P. paniculosa* subsp. *paniculosa*, in having entire leaves which are rather densely simple-hispid on the upper surface as in the latter taxon, but larger (to 2.5 cm) and resembling the former in shape.

***Pomaderris halmaturina* subsp. *continentis* N. G. Walsh subsp. nov.**

P. halmaturina sensu Jessop in J. P. Jessop & H. R. Toelken (eds), Fl. S. Australia 2:812 (1986) *pro parte*.

P. oraria sensu J. H. Willis, Handb. Pl. Vic. 2:366 (1973) *pro parte*, non F. Muell. ex Reisseck (1858).

a subspecie typica floribus parvioribus (sepala c. 1.7×1 mm, thalamus 1–1.5 mm longus) et foliis margine sinuato non dentato differt.

HOLOTYPE: Victoria, Lower Glenelg River, far SW Victoria, on steep limestone banks between Eaglehawk Bend and Blackfish Ck, 29.x.1948, *J. H. Willis s.n.* (MEL 55384).

Differs from the typical subspecies in its leaves with sinuate, not dentate margins, and in its smaller flowers (thalamus tube 1–1.5 mm long, sepals c. 1.7×1 mm). Furthermore, in most specimens the leaves are relatively narrower, more acute at the base and apex, and have more deeply impressed lateral veins than the typical subspecies. Grows to at least 4 m high (cf. to 3 m recorded for *P. halmaturina* subsp. *halmaturina*). (Fig. 7)

REPRESENTATIVE SPECIMENS (Total examined 10):

Victoria—South-west, South Winnap, Lower Glenelg, 31.x.1948, *J. H. Willis s.n.* (MEL); South-west, Glenelg River at Keegans Bend, c. 4 miles (7.2 km) S of Drik Drik, 22.x.1960, *H. I. Aston 767* (MEL); South-west study area, 13 km E of Dergholm, 11.iii.1984, *A. C. Beaglehole 76428* (MEL); Lower Glenelg River, Jones Cliff, Keegans Bend, ii.1946, *A. C. Beaglehole 17192* (MEL).

South Australia—Hundred of Killanoola, NW corner, c. 30 km S of Narracoorte, 10.x.1965, *D. Hunt 2503* (AD); South-east, xi.1937, *Mr Muchell* (AD).



Fig. 7. *Pomaderris halmaturina* subsp. *continentis*. a—flowering twig, $\times 1$. b—flower, $\times 8$. c—undersurface of leaf, $\times 4$, inset, $\times 10$. Drawn from the holotype.

DISTRIBUTION AND CONSERVATION STATUS (Fig. 9):

Apparently confined to the far south east of South Australia where known from only two collections (above), and adjacent areas of Victoria along the Glenelg River and its major tributaries south of Dergholm. *Pomaderris halmaturina* subsp. *continentis* is regarded as vulnerable. Its risk code is assessed at 3VCi (Briggs and Leigh, 1989). It occurs within the Lower Glenelg National Park, Victoria.

HABITAT:

In Victoria the subspecies is known from steep limestone-rich embankments near to and immediately adjacent to the Glenelg River where it occurs in *Eucalyptus pryoriana* open-forest, *E. ovata* riparian woodland and dense shrubland with *Pultenaea hispidula*, *Bursaria spinosa*, *Acacia myrtifolia* and *Correa reflexa*. On sandy soils developed on undulating country above the steep fall to the Glenelg River, plants occur in *E. baxteri* open forest. Associated species and habitat details are unknown for the taxon in South Australia, but the prevalence of old calcareous dunes in the region suggests that the subspecies may be confined to limestone country.

NOTES:

Jessop (1986), remarks on the resemblance of the specimen from near Narracoorte to *P. aspera*, the commonest member of the genus in Victoria. *P. aspera* differs from *P. halmaturina* in its larger leaves with rugose, prominently reticulate upper surfaces, in the larger, looser panicles and in the ovary which becomes semi-superior as it matures.

The subspecific epithet refers to the mainland occurrence of an otherwise mainly insular species.

5. *Pomaderris oblongifolia* N. G. Walsh *sp. nov.*

P. oraria *sensu* J. H. Willis, Handb. Pl. Vic. 2:366 (1973) *pro parte, non* F. Muell. *ex* Reisseck (1858).

ab aliis speciebus prope *P. orariam* F. Muell. *ex* Reisseck foliis oblongis vestitus indumento tenuissimo stellato distinguitur.

HOLOTYPE: Victoria, Gippsland, Tulach Ard Gorge, western bank of Snowy R., c. 28 km NE from Buchan; 37° 17'50"S, 148° 21'00"E, alt. c. 100 m, 15.xi.1988, N. G. Walsh 2191 and K. C. Norris (MEL 1564062). ISOTYPI AD, BRI, CANB, CHR, HO, K, NSW.

Slender shrub to c. 2 m high. *Stipules* narrow-subulate, to 5 mm long, densely stellate pubescent. *Leaves* alternate, oblong or narrow elliptic, mostly 2–6 × 0.6–1.5 cm, upper surface glabrous to densely and minutely stellate hispid, lower surface densely covered with fine pale, stellate tomentum, with scattered larger, rusty stellate hairs. *Inflorescence* of slender terminal and near-terminal axillary panicles to c. 5 cm long. *Flowers* densely covered with fine, rusty or pinkish, stellate hairs externally; thalamus tube conical, c. 1 mm long; sepals acute, 1.5–2 × c. 1 mm, the inner surface crimson; stamens subequal to sepals; anthers oblong, c. 1 mm long; style c. 0.7 mm long, trifid almost to base. Capsule c. 2.5 mm long; cocci c. 2 mm long, elliptic, dorsal surface almost flat, ventral surface keeled, operculum about 4/5 as long as coccus; seeds not seen.

Distinguished from other members of the *P. oraria* complex by the oblong leaves which are invested with an extremely fine, stellate indumentum. (Fig. 8)

REPRESENTATIVE SPECIMENS (Total examined 12):

Victoria—Snowy River Gorge, approx. 1.9 km NW of junction of Snowy R. & Mountain Ck, 37° 18'S, 148° 21'E, 18.i.1987, J. Eichler *s.n.* & J. Turner (MEL); Little R. Gorge, E of Wulgulmerang, 12.xi.1968, J. H. Willis *s.n.* (MEL); Snowy R. banks, east of Butchers Ridge, 31.viii.1952, N. A. Wakefield 4691 (MEL); Snowy R. gorge, E of Butchers Ridge, W Tree, 21.iv.1957, J. H. Willis *s.n.* (MEL). Snowy R. Gorge, E of Fork Track, 31.iii.1971, A. C. Beaglehole 37700 & K. C. Rogers (MEL, NSW).



Fig. 8. *Pomaderris oblongifolia*. a—flowering twig, $\times 1$. b—flower, $\times 10$. c—lower surface of leaf, $\times 4$. d—t.s. of leaf, $\times 20$. Drawn from the holotype.

DISTRIBUTION AND CONSERVATION STATUS (Fig. 9):

Known only from the gorge tract of the Snowy River, from its confluence with Little River downstream to New Guinea Bend, and from Little River at and below Little River Gorge. The species is regarded as rare, with risk code assessed at 2RCat (Briggs and Leigh, 1989). All known populations are reserved in the Snowy River National Park.

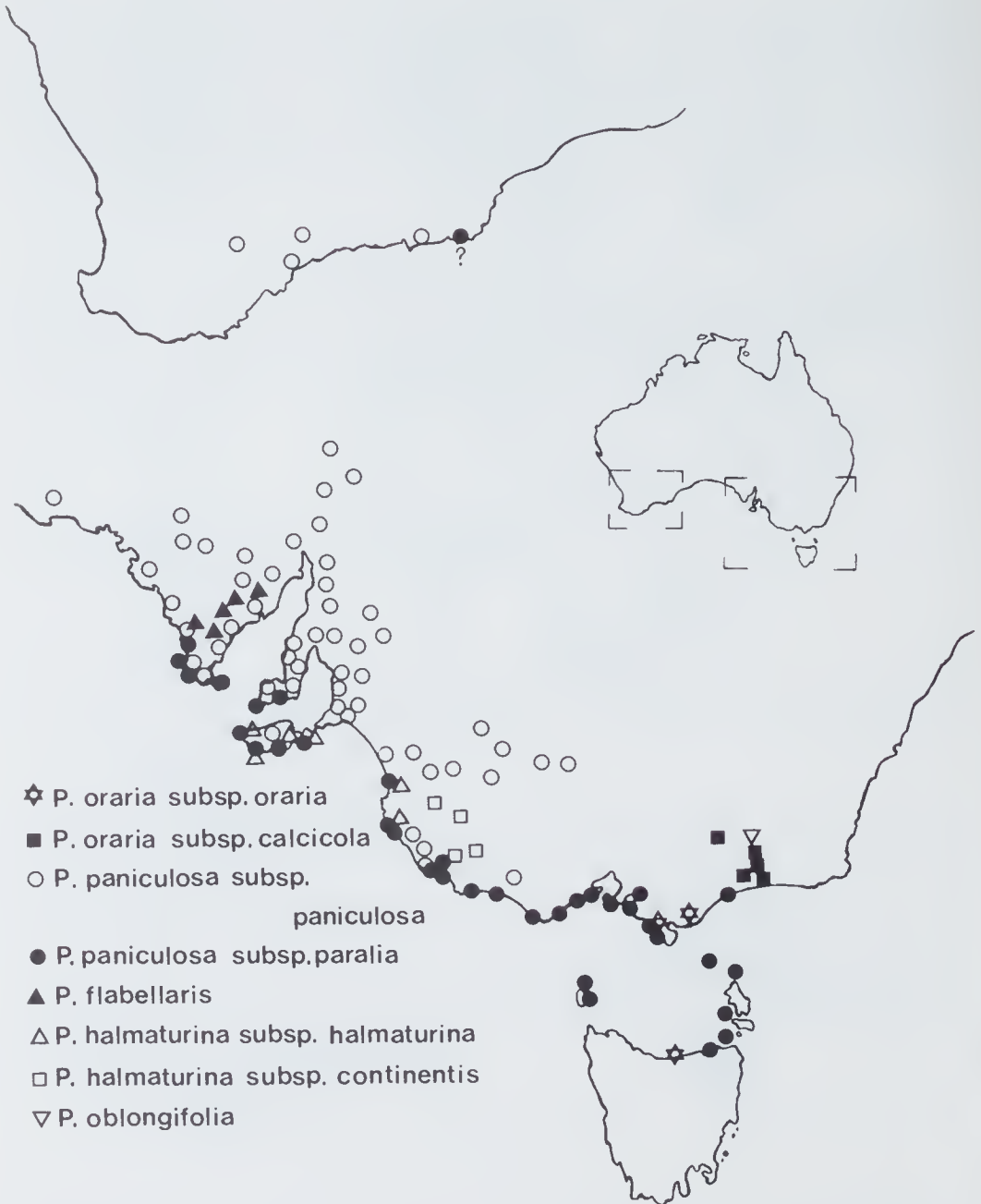


Fig. 9. Distribution of the *Pomaderris oraria* complex in Australia.

HABITAT:

The species occurs amongst rhyolitic boulders (Snowy River Volcanics) at about and slightly above the flood level of the rivers on broader, less steep banks between the contracted sections of the gorges. The community is a dense shrubland with dominant species including *Acacia boormanii*, *A. floribunda*, *Bursaria spinosa*, *Kunzea ericoides*, *Phebalium glandulosum* and *Calytrix tetragona*.

NOTES:

This is the entity referred to by Willis (1973) under *P. oraria* as a 'variant or perhaps related . . . species . . . of the Snowy R. gorge'. It bears a superficial resemblance to some larger-leaved specimens of *P. helianthemifolia* and *P. angustifolia* but both of those species have a glabrous ovary which becomes prominently raised toward maturity. In foliar characters *P. helianthemifolia* can be distinguished from *P. oblongifolia* in having simple hairs along the nerves on the lower (and often upper) surface. *P. angustifolia* typically has smaller (c. 1–2 cm long) leaves with strongly recurved margins and a sparser, coarser tomentum on the upper surface than does *P. oblongifolia*.

The gorge tract and lower reaches of the Snowy River are remarkable for the high number of species largely confined to it or which have major disjunctions in its vicinity (e.g. *Wesringia cremnophila*, *Leucopogon riparius*, *Brachycome riparia*, *Acacia subulineris*, *Dodonaea rhombifolia*, *Phebalium glandulosum* etc).

The specific epithet refers to the characteristic leaf-shape of the species.

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Note added in press: *Pomaderris oraria* subsp. *oraria* was collected in January, 1990, from Flinders Island in Bass Strait [mid west coast near Reedy Lagoon, 39° 54'S, 147° 53'E: D. Albrecht 3923 (MEL)].

NEW SPECIES OF *HIBBERTIA* Andr. (DILLENIACEAE) IN NEW SOUTH WALES, AUSTRALIA.

by

BARRY J. CONN*

ABSTRACT

Conn, Barry J. New species of *Hibbertia* (Dilleniaceae) in New South Wales, Australia. *Muelleria* 7(2): 289–294 (1990).—*Hibbertia acuminata*, *H. covenyana*, *H. circumdans*, *H. kaputarensis*, *H. marginata* and *H. villosa* are described.

INTRODUCTION

The genus *Hibbertia* Andr. is known to contain many undescribed taxa. This paper validates six new names so that they may be included in a treatment of the genus for the forthcoming 'Flora of New South Wales'. The elucidation of other undescribed taxa of this genus, within New South Wales, must await revisionary studies.

The distribution summary and the selected citation of specimens examined are grouped according to Anderson (1961), as modified by Jacobs & Pickard (1981). All NSW Herbarium specimen numbers cited in this paper are treated as sheet numbers.

1. *Hibbertia villosa* Conn, *sp. nov.*

H. sp. A, Jacobs & Pickard, Plants of New South Wales—A census of the Cycads, Conifers and Angiosperms 110 (1981).

Frutices erecti, 0.2–1.3 m alti. *Ramuli* dense ad moderate villosi; pili albidi patentes ad antrorsi, 1–3 mm longi. *Folia* dense ad moderate villosa, sessilia; lamina anguste obovata usque spatulata, 7–27 mm longa, 3–10 mm lata, plana, basi attenuata, margine integro vel dentato, apice plus minusve obtuso et cum mucrone circa 0.2 mm longo. *Flores* axillares, sessiles. *Sepala* anguste ovata, 6.3–9 mm longa, apice acuto, sepalis interioibus glabris, sepalis aliis vestitis distaliter. *Petala* spatulata, 10–23 mm longa, 7–10 mm lata. *Stamina* in fasciculis 3, circum carpella 15–25, 3.8–4 mm longa. *Carpella* plerumque 3, glabra. *Fructus* haud visus.

TYPUS: *Lander* 526, 3.x.1974, c. 1.5 km S of 'The Haystack' on Wade's Road, Gibraltar Range National Park, Northern Tablelands, New South Wales (HOLOTYPE: NSW; ISOTYPE: MEL).

Erect shrub, slender to robust, 0.2–1.3 m high; branches and leaves densely to moderately villous; hairs whitish, spreading to antrorse, 1–3 mm long. *Leaves* sessile, with lamina narrowly obovate to spatulate, 7–27 mm long, 3–10 mm wide, flat; base tapering; margin entire or occasionally toothed; apex obtuse with a small blunt mucro c. 0.2 mm long. *Flowers* axillary, sessile. *Bracts* c. 1.5 mm long, densely hairy (as for leaves). *Sepals* narrowly ovate, 6.3–9 mm long; apex acute; 2 'inner' sepals glabrous; remaining sepals with outer surface glabrous basally and hairy on distal half, inner surface glabrous basally and sparsely hairy distally. *Petals* spatulate, 10–23 mm long, 7–10 mm wide. *Stamens* usually arranged in 3 groups around carpels, 15–25, 3.8–4 mm long. *Carpels* usually 3, glabrous. *Fruits* not seen.

HABITAT:

Occurs in open forests dominated by *Eucalyptus obliqua*, *E. cameronii*, *E. andrewsi* (Waterhouse & Gee s.n.) and *E. resinifera* (Williams 601). Associated species include *Melichrus procumbens*, *Petrophile canescens*, *Restio fimbriatus* and *Lepyrodia scariosa* (McGillivray 2417). It grows in shallow skeletal sandy soils overlying granite.

* National Herbarium of New South Wales, Mrs Maquarie's Road, Sydney, New South Wales, Australia 2000.

FLOWERING PERIOD:

August to November.

ETYMOLOGY:

The specific epithet refers to the indumentum of the branches and leaves.

CONSERVATION STATUS:

Risk Code = 2R (Briggs & Leigh 1988).

ADDITIONAL SPECIMENS EXAMINED:

New South Wales—Northern Tablelands: *Floyd s.n.*, 31.x.1956, c. 20 miles E of Glen Innes, along the Gwydir Highway, Gibraltar Range State Forest (NSW 85998); *Floyd s.n.*, 1.xi.1956, along Kempsey-Armidale road, Styx River State Forest (NSW 85997); *McGillivray 2417*, 20.ix.1966, 39.5 km ENE of Glen Innes, on the Gwydir Highway (NSW); *Williams 601 & Winterhalder*, 5.x.1958, 40 miles E of Glen Innes, Gibraltar Range State Forest (NSW 85996); *Burgess s.n.*, 26.ix.1960, 36 miles ENE of Glen Innes (NSW 85994); *Burgess s.n.*, 26.ix.1960, Boundary Creek, 35 miles E of Glen Innes (NSW 85995). North Coast: *Waterhouse & Gee s.n.*, 31.viii.1979, just E of 1st crossing of Forbes River, Hastings Forest Highway, Mt Boss State Forest (NSW).

NOTES:

This species has close affinities with *H. diffusa* R.Br. ex DC. However, *H. diffusa* has glabrous sepals and the branches and leaves are shortly hairy, often appearing glabrous. Furthermore, the leaves are often toothed or slightly lobed in *H. diffusa*.

The 'inner' sepals refer to those that are marginally overlapped by the adjacent sepals in the quincuncial arrangement.

2. *Hibbertia acuminata* Conn, *sp. nov.*

Frutices erecti vel procumbentes, 0.3–1 m alti. *Ramuli et folia* juvenilia pilis albidis moderate ad dense obiecta; pili patentes ad antrorsi, 0.3–1 mm longi. *Folia* sessilia; lamina anguste obovata, 10–35 mm longa, 2–10 mm lata, plana, basi attenuata, margine integro vel interdum distale dentato, apice plus minusve obtuso et cum mucrone circa 0.5 mm longo. *Flores* axillares, sessiles. *Sepala* ovata, 7–10 mm longa, margine incurvato, apice acuminato et ciliato, pagina externa moderate ad dense pilosa, interiores glabris. *Petala* spatulata, circa 12 mm longa, circa 10 mm lata. *Stamina* in fasciculis 3, circum carpella, circa 40–45, 2–3 mm longa. *Carpella* 3, glabra.

TYPUS: *Blakely & Shiress s.n.*, -.vii.1922, Ramornie, 3 mile NW of Copmanhust, North Coast, New South Wales (HOLOTYPUS: NSW 86434; ISOTYPI: NSW 86440 & NSW 219491).

Erect shrub or sometimes weak and procumbent, 0.3–1 m high; branches and young leaves moderately to densely hairy; hairs whitish, spreading to antrorse, 0.3–1 mm long. *Leaves* sessile, with lamina narrowly obovate, 10–35 mm long, 2–10 mm wide, flat; base tapering; margin entire or occasionally toothed distally; apex obtuse with a small blunt mucro c. 0.5 mm long. *Flowers* axillary, sessile. *Bracts* 3–4 mm long, moderately hairy. *Sepals* ovate, 7–10 mm long; margin incurved distally, such that apex appearing acuminate and ciliate; outer surface densely hairy; inner surface glabrous. *Petals* spatulate, c. 12 mm long, c. 10 mm wide. *Stamens* usually arranged in 3 groups around carpels, c. 40–45, 2–3 mm long. *Carpels* 3, glabrous. *Seeds* subglobular, mid-brown, smooth, 2–2.5 mm diameter.

HABITAT:

Occasional shrub in coastal heathlands or sclerophyll forests of the ranges. Associated species include *Banksia serratifolia*, *Melaleuca nodosa*, *Persoonia cornifolia*, *P. virgata*, *Leucopogon virgatus* and *Styphelia triflora* (McGillivray 2304). Occurs in sandy to rocky soil overlying sandstone.

FLOWERING PERIOD:

July to November.

ETYMOLOGY:

The specific epithet refers to shape of the sepals.

CONSERVATION STATUS:

The conservation status of this species is not known.

ADDITIONAL SPECIMENS EXAMINED:

New South Wales—North Coast: *Blakely & Shiress s.n.*, -vii.1922, Mt Mullengen, 4 mile E of Ramornie (NSW 86435); *Boorman s.n.*, -ix.1909, Byron Bay (NSW 86412); *Boorman s.n.*, -x.1909, Coledale Creek, Coledale Road (NSW 86436); *Boorman s.n.*, -v.1916, Cangai, Upper Clarence River (NSW 86439); *Boorman s.n.*, -viii.1916, Mt Warning, Tweed River (NSW 86415); *Constable s.n.*, 18.x.1961, Corindi-Red Rock Road, 20 miles NNE of Coffs Harbour (NSW 66303); *Dodkin 74*, 24.ix.1975, Cabbage Tree Creek, Mt Neville, NW of Whiporie (NSW); *McGillivray 2304*, 5.vii.1966, 0.75 miles from coast and c. 5 miles directly S of Wooli (NSW); *Rupp s.n.*, -ix.1909, Copmanhust (NSW 86402).

NOTES:

This species has close affinities with *H. obtusifolia* DC. It differs from that species by having the margin of the sepals incurved such that the sepals appear acuminate (margin of sepals not incurved in *H. obtusifolia*, so apex obtuse to acute).

A smaller-leaved variant (c. 10 mm long), represented by *Boorman s.n.*, -xi.1909 (NSW 86412), *Boorman s.n.*, -v.1916 (NSW 86439) and *Boorman s.n.*, -viii.1916 (NSW 86415) may represent a distinct taxon.

3. *Hibbertia kaputarensis* Conn, *sp. nov.*

Frutices erecti, 0.4–0.6 m alti. *Ramuli et folia* pilis albidis dense obtecta; pili plus minusve antrorsi, 0.2–1 mm longi. *Folia* sessilia; lamina anguste obovata, 10–40 mm longa, 2–7 mm lata, plana, basi attenuata, margine integro, apice rotundato vel emarginato, interdum parum apiculato. *Flores* axillares, sessiles. *Sepala* ovata, 6.5–10 mm longa, apice obtuso, pagina externa dense tomentosa, pagina interna glabro vel ad apicem pilosa. *Petala* spatulata, 9–12 mm longa, 9–13 mm lata. *Stamina* in fasciculis 3, circum carpella, circa 100, 4.5–6 mm longa. *Carpella* 3, glabra. *Semina* subglobulares, 2–2.5 mm diametro.

TYPUS: *Coveny 8892 & Roy*, 21.xi.1976, Entrance to Mt Kaputar National Park on Dawsons Spring Road, 28 km ENE of Narrabri, Northern Tablelands, New South Wales (HOLOTYPE: NSW).

Erect shrub 0.4–0.6 high, branching from near base; branches and leaves densely hairy; hairs whitish, antrorse, 0.2–1 mm long. *Leaves* sessile, with lamina narrowly obovate, 10–40 mm long, 2–7 mm wide, flat; base tapering; margin entire; apex rounded or emarginate, sometimes slightly apiculate. *Flowers* axillary, sessile. *Bracts* c. 6.5 mm long, densely hairy. *Sepals* ovate, 6.5–10 mm long; apex obtuse; outer surface densely rusty- or white-tomentose; inner surface glabrous, except often hairy near apex. *Petals* spatulate, 9–12 mm long, 9–13 mm wide. *Stamens* usually arranged in 3 groups around carpels, c. 100, 4.5–6 mm long. *Carpels* 3, glabrous. *Seeds* subglobular, reddish mid-brown, smooth, 2–2.5 mm diameter.

HABITAT:

A common species in heathlands and open forests in the Mt Kaputar National Park and adjacent hills. It occurs in shallow soils in rocky areas.

FLOWERING PERIOD:

November to December.

ETYMOLOGY:

The specific epithet refers to the occurrence of this species in the Mt Kaputar National Park and adjacent hills.

CONSERVATION STATUS:

Risk Code = 2RC (Briggs & Leigh 1988).

ADDITIONAL SPECIMENS EXAMINED:

New South Wales—North Western Slopes: *Boorman s.n.*, -vi.1904, Howell (NSW 86179); *Rodd 4238*, 2.xii.1984, Waa Gorge, Nandewar Range (NSW). Northern Tablelands: *Constable 62*, 14.xii.1961, Coryah Gap, Nandewar Range, c. 20 miles ENE of Narrabri (NSW 66295); *Coveny 8873 & Roy*, 21.xi.1976, 26 km ENE of Narrabri towards Dawsons Springs (NSW); *Hoogland 12302*, 3.xi.1972, along Mt Kaputar road (NSW).

NOTES:

This species is closely related to *H. obtusifolia*. This new species is characterized by the densely rusty-tomentose to whitish-tomentose calyx (cf. *H. obtusifolia* that has a sparsely hairy or glabrous calyx, often with margin ciliate).

4. *Hibbertia covenyana* Conn, *sp. nov.*

Frutices erecti vel semiprostrati, usque 0.5 m alti. *Ramuli* et folia cum pilis stellatis simplicibusque albidis dense obiecta; pili circa 0.1 mm longi vel 0.6–1 mm longi. *Folia* sessilia; lamina oblonga, 4–10 mm longa, 1–2 mm lata, basi plus minusve acuta, margine integro et recurvato, apice obtuso. *Flores* axillares, pedicellati, pedicello 10–15 mm longo. *Sepala* ovata, 7.5–10 mm longa, apice acuto, extra dense tomentosa, sepalis interioribus ex parte glabris. *Petala* spatulata, 10–14 mm longa, 10–13 mm lata. *Stamina* unilateralia, 7–10, circa 4 mm longa. *Carpella* 2, tomentosa, cum pilis simplicibus albidis. *Fructus* haud visus.

TYPUS: *Coveny 9042 & Roy*, 24.xi.1976, 82 km SSW of Narrabri by road towards Coonabarabran, North Western Slopes, New South Wales (HOLOTYPE: NSW: ISOTYPE *n.v.*: A, CANB, K, L, LE, MO, PRE, RSA).

Erect shrub branching from near base or semiprostrate, to 0.5 m high; branches and leaves densely hairy; hairs whitish, short hairs stellate (c. 0.1 mm long) and long hairs simple (0.6–1 mm long). *Leaves* sessile, with lamina oblong, 4–10 mm long, 1–2 mm wide; base acute; margin entire, recurved such that most of abaxial surface not visible; apex obtuse. *Flowers* axillary, pedicellate; pedicel 10–15 mm long (as short as 5 mm long in bud). *Bracts* 3.5–6.5 mm long, densely hairy (as for leaves). *Sepals* ovate, 7.5–10 mm long; apex acute; outer surface densely hairy, with stellate hairs persistent and simple hairs soon deciduous; 'outer' 2 sepals with inner surface moderately to densely covered with stellate hairs; remaining 3 sepals with inner surface glabrous, except for a few stellate hairs near apex. *Petals* spatulate, 10–14 mm long, 10–13 mm wide. *Stamens* arranged on one side of carpels, 7–10, c. 4 mm long. *Carpels* 2, densely hairy with white simple hairs. *Fruits* not seen.

HABITAT:

This species occurs in *Eucalyptus dealbata* dominated woodlands, associated with *Triodia* sp. and *Xanthorrhoea australis* (*Rodd s.n.*, 29.ix.1968). It occurs in trachyte-derived soils near the summit of Mt Nombi (altitude c. 700 m) (*Rodd s.n.*) or common in light brown sand with lateritic gravel (*Coveny 9042*).

FLOWERING PERIOD:

September to November.

ETYMOLOGY:

The specific epithet honours Robert Coveny who has made extensive collections throughout Australia, in particular New South Wales, and who collected the type specimen.

CONSERVATION STATUS:

The conservation status of this species is not known.

ADDITIONAL SPECIMENS EXAMINED:

New South Wales—North Western Slopes: *Mackay 29*, 19.xi.1981, Denobollie State Forest (NSW); *Rodd s.n.*, 29.ix.1968, Mt Nombi, 17 miles SW of Mullalley (NSW—2 sheets).

NOTES:

This species shares many features with *H. sericea* (R.Br. ex DC.) Benth. (viz. both have stellate indumentum, more or less oblong leaves and a few stamens arranged to one side of the 2 carpels), however the flowers of this species are pedicellate (cf. sessile in *H. sericea*).

The 'outer' sepals refers to the 2 sepals that marginally overlap, at least in part, the other 3 sepals.

5. *Hibbertia circumdans* Conn, *sp. nov.*

Frutices erecti. 0.2–0.6 (–1.3) m alti. *Ramuli* pilis albidis dense obiecti; pili crispi ad stricti plus minusve antrorsi, 0.1–1 mm longi. *Folia* sessilia; lamina spatulata, 5–12 mm longa, 1–5 mm lata, plicata, margine lobato, apice truncato. *Flores* terminales, sessiles. *Sepala* ovata, 5–6.5 mm longa, glabra, margine ciliato, apice rotundato. *Petala* spatulata, 5.5–11 mm longa, 6–11 mm lata. *Stamina* circum carpella, 15–30, 2–2.5 mm longa. *Carpella* 3, glabra. *Fructus* haud visus.

TYPUS: *Hoogland 12320*, 7.xi.1972, Glen Davis Road, 3 miles from Capertee, Central Tablelands, New South Wales (HOLOTYPE: NSW: ISOTYPI *n.v.*, CANB, HBG, K, L, UC).

Erect shrub 0.2–0.6(–1.3) m high; branches moderately hairy; hairs whitish, curled to straight, antrorse, 0.1–1 mm long. *Leaves* sessile, moderately to sparsely hairy, with lamina spatulate, 5–12 mm long, 1–5 mm wide, folded longitudinally, recurved; base abruptly long tapering; margin usually with 2, prominent lobes distally; apex truncate. *Flowers* terminal on short branchlets, sessile. *Bracts* c. 2 mm long. *Sepals* ovate, 5–6.5 mm long, glabrous except for ciliate margin; apex rounded. *Petals* spatulate, 5.5–11 mm long, 6–11 mm wide. *Stamens* arranged around carpels, 15–30, 2–2.5 mm long. *Carpels* 3, glabrous. *Fruits* not seen.

HABITAT:

This widespread, and often common species forms part of the shrub layer of open sclerophyll forests and tall woodlands in sandy sandstone-derived soils or gravelly clays.

FLOWERING PERIOD:

Mostly August to November.

ETYMOLOGY:

The specific epithet refers to the arrangement of the stamens around the carpels.

CONSERVATION STATUS:

This species does not appear to be endangered.

ADDITIONAL SELECTED SPECIMENS EXAMINED (22 seen):

New South Wales—Central Coast: *Whaite 1061*, 30.ix.1951, Little River, Buxton (NSW 86383); *Dunn & James 579*, 1.xi.1984, Appin to Wilton Road at crossing of Cataract River, c. 5 km SW of Appin (NSW). Central Tablelands: *Coveny 3582*, 7.iv.1971, 8 miles N of Clarence on the Newnes Tunnel Road (NSW); *Hoogland 12321*, 7.xi.1972, Along Capertee River c. 3 miles below Glen Davis (NSW). North Western Slopes: *Boorman s.n.*, –ix.1916, Coonabarabran (NSW 86470). Central Western Slopes: *Hoogland 12314 & 12315*, 6.xi.1972, Lees Pinch, c. 30 miles NE of Mudgee (NSW).

NOTES:

This species shares many features with *H. monogyna* R.Br. ex DC. (viz. both have spatulate lobed leaves, an indumentum of simple hairs and the stamens arranged around the carpels), however the flowers of this species have 3 carpels (cf. one in *H. monogyna*) and 15–30 stamens (cf. 10–12 in *H. monogyna*).

6. *Hibbertia marginata* Conn, *sp. nov.*

Frutices usque 0.4 m alti. *Ramuli* pilis albidis moderate ad dense obtecti; pili stricti plus minusve patentes, 0.5–1 mm longi. *Folia* breviter petiolata, petiolo 0.5–1 mm longo; lamina anguste ovata ad suboblonga, 24–35 mm longa, 4–7 mm lata, plana, basi obtusa, margine integro et recurvo, apice obtuso ad parvum apiculato. *Flores* terminales, sessiles. *Sepala* ovata, 15–20 mm longa, ex parte pilis dense oblecta, apice acuminato. *Petala* spatulata, circa 20 mm longa, circa 16 mm lata. *Stamina* circum carpella, 30–40, 6.5–8 mm longa. *Carpella* 3, dense tomentosa. *Fructus* haud visus.

TYPUS: *Hill 2752, Johnson & Weston*, 19.x.1987, Mt Neville fire trail, 0.5 km S of gate in tick fence, Mt Marsh State Forest, North Coast, New South Wales (HOLOTYPE: NSW 206551).

Suckering shrub to 0.4 m high; branches moderately to densely hairy; hairs whitish, straight, spreading, 0.5–1 mm long. *Leaves* shortly petiolate; petiole 0.5–1 mm long; lamina narrowly ovate to suboblong, 24–35 mm long, 4–7 mm wide, flat; base obtuse; margin entire, recurved; apex obtuse to slightly apiculate; both surfaces sparsely hairy. *Flowers* terminal on short branchlets, sessile. *Bracts* c. 10 mm long, leaf-like. *Sepals* ovate, 15–20 mm long, densely hairy, except for broad marginal and apical region; apex acuminate. *Petals* spatulate, c. 20 mm long, c. 16 mm wide. *Stamens* arranged around carpels, 30–40, 6.5–8 mm long. *Carpels* 3, densely hairy. *Fruits* not seen.

HABITAT:

This species has been recorded as occurring in a grassy forest dominated by *Eucalyptus pilularis*, *E. intermedia* and *Angophora woodsiana* (*Hill 2752*). It occurs in sandy loam amongst a rugged sandstone outcrop.

FLOWERING PERIOD:

October.

ETYMOLOGY:

The specific epithet refers to the distinct marginal region of the sepals.

CONSERVATION STATUS:

Since this species is only known by the type collection, its conservation status is not known. It is locally frequent (*Hill 2752*) in the Mt Marsh State Forest.

NOTES:

This species has its closest affinities with *H. saligna* R.Br. ex DC. It differs from that species by having shortly, but distinctly petiolate leaves (cf. *H. saligna* has sessile, slightly stem-clasping leaves), hairy carpels (cf. *H. saligna* has glabrous carpels) and although both have hairy sepals, those of *H. marginata* have a broad marginal and apical region that is significantly less hairy than the rest of the sepals.

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A NEW SPECIES OF *ACROTRICHE* R. Br. (EPACRIDACEAE) FROM SOUTH-EASTERN AUSTRALIA.

by

P. C. JOBSON* and T. WHIFFIN

ABSTRACT

Jobson, P. C. and Whiffin, T. A new species of *Acrotriche* R. Br. (Epacridaceae) from South-Eastern Australia. *Muelleria* 7(2): 295-299 (1990).—A new species of *Acrotriche*, *A. leucocarpa* P. Jobson & T. Whiffin from the Southern Tablelands of New South Wales and East Gippsland, is described and discussed.

INTRODUCTION

Acrotriche R. Br., a member of the Epacridaceae, may be distinguished from the closely related genera *Monotoca* R. Br. and *Leucopogon* R. Br. by the presence of hair tufts near the apex of the corolla lobes. The generic name comes from the Greek 'akron' and 'thrix' meaning hairs on the apex.

The genus occurs in the Australian States but not in the Northern Territory. The highest diversity occurs in South Australia. Plants are found chiefly in open heathlands and forested habitats along the ranges and coast, usually on low nutrient soils.

Paterson (1960, 1961, 1962) revised the genus using both morphological and anatomical techniques. At the time she recognised twelve species; subsequently, Jackes and Powell (1980) described a new species and transferred a species from *Monotoca* to *Acrotriche* making the current total fourteen.

Populational studies conducted on *A. aggregata* R. Br. and *A. divaricata* R. Br. indicated the presence of an undescribed taxon from southern New South Wales and East Gippsland. Herbarium specimens from CBG, MEL and NSW were examined, as well as field collected material from a total of 16 populations were studied for leaf morphology, leaf flavonoids and leaf wax alkanes (Jobson, 1988). Paterson (1960) mentioned the presence of a white-leaved form from southern New South Wales and placed it with *A. divaricata*.

TAXONOMY

Acrotriche leucocarpa P. Jobson *et* T. Whiffin *sp. nov.*

Frutex ramosissimus hemisphaericus. *Folia* lanceolata, 8–11 mm longa, 3–4 mm lata, laminis planis, apicibus mucronatis; pagina infera laminae in aspecto alba, cum papillis minimis tecta. *Flora* viridia, sepalis apicibus roseis. *Fructus* margaritaceo-alba, translucentes.

TYPUS: New South Wales, Southern Tablelands, Junction of 'Minuma Range' and 'Badja' Tracks, below Big Badja Hill, c. 40 km N of Numeralla. 35° 59'S; 149° 34'E, 31 May 1988, P.C. Jobson 342 (HOLOTYPE: MEL 156200; ISOTYPE: LTB, NSW, MEL 156199).

A low erect, much branched *shrub*, 0.5–1 m high, young branches hirsute. *Leaves* lanceolate, spreading, flat, 8–11 mm long, 3–4 mm wide, apex with a pungent point, margins entire; upper surface glabrous, lower surface covered in microscopic papillae giving it a milky-white appearance. *Flowers* wholly green or tips of corolla lobes with reddish tinge, 3–5 in short axillary spikes or clusters, on first year wood. *Bracteoles* keel-shaped, 0.5 mm long. *Sepals* glabrous, broadly ovate, obtuse, 1.25

Department of Botany, La Trobe University, Bundoora, Victoria, Australia 3083.

* Present address: Department of Botany, James Cook University, Townsville, Queensland, Australia 4811.

mm long, 0.75 mm wide, frequently tipped red. *Corolla* tube 1.5–2 mm long, lobes 1 mm long, spreading, tuft of hairs at the neck of the corolla tube arising from the epidermal cells. *Anthers* orange, oblong, 0.5 mm long. *Ovary* with alternating vertical red and green bands, globular, glabrous, 4–5 celled, 1 mm diameter, 1 mm long. *Nectary* scarcely lobed, 0.5 mm high; style conical, 0.5 mm long; stigma more or less flat. *Mature fruit* pearly-white, translucent, 5 mm diameter. (Fig. 1)

KEY TO RELATED TAXA

1. Abaxial leaf surface green *A. divaricata*
1. Abaxial leaf surface white 2
2. Mature fruit red, leaves 10–19 mm long *A. aggregata*
2. Mature fruit white, leaves 8–11 mm long *A. leucocarpa*

SELECTED SPECIMENS EXAMINED (Total 22):

New South Wales—Southern Tablelands: Spur on the E face of Wog Wog Mountain, 37° 05'45"S, 149° 26'20"E, c. 800 m, 25.ix.1984, *D. E. Albrecht* 1063 (MEL); On the SE side of a prominent bluff, 2.4 km N of Wadbilliga trig, Wadbilliga National Park, 36° 19'S, 149° 36'E, 1200 m, 27.iii.1985, *J. D. Briggs & P. H. Weston* 1820 (CANB, NSW); Kanangra Walls, 35 km SW of Katoomba, 0.8 km NE of Kittani Top, 13.v.1978, *M. D. Crisp* 4011 (CBG); Upper Cotter River near Gallipoli Flat, Namadgi National Park, 35° 35'30"S, 148° 49'E, 1010 m, 5.xi.1987, *P. Gilmour* 6250 (CBG); type locality, 31.v.1988, *P. C. Jobson* 339 (LTB, NSW); *ibidem*, *P. C. Jobson* 340, 341, 343 (LTB, NSW, MEL); Canberra, –.ix.1928, *H. B. Williamson* s.n. (MEL 645107); Tinberry Mountains (c. 55 km SSE of Canberra, E of Michelago, south declivities of S Tinberry Peak at c. 4200 ft, 22.iv.1978, *J. H. Willis* s.n. (MEL 1513677).

Victoria—East Gippsland: Wulgulmerang Road at crossing on Boundary Creek, c. 100 m NE of bridge, 37° 07'S, 148° 14'E, 800 m, 10.ix.1985, *D. E. Albrecht* 2421 (MEL); Rocky outcrop on west side of Mt Coopracambra summit, 37° 16'S, 149° 17'E, *D. E. Albrecht* 3673 (CBG, HO, MEL, NSW); Nunniong Plateau, Reedy River chasm area, 4.ii.1973, *A. C. Beauglehole* 41372 (MEL); Little River Falls, 16.i.1948, *N. A. Wakefield* 2288 (MEL); Mt Elizabeth c. 16 miles NNE of Buchan, 16.ix.1968 *J. H. Willis* s.n. (MEL).

ETYMOLOGY:

The specific epithet of this taxon alludes to the white drupe which is characteristic of this species.

HABITAT:

Acrotriche leucocarpa is found in open eucalypt woodlands where it is a common understorey shrub. It favours high altitudes of between approximately 900 m and 1300 m. The species tend to grow on red sandy clay over a sandstone bedrock.

DISTRIBUTION (Fig. 2):

The species is found from the Kanangra Walls area south, along the main range of the Great Dividing Range to East Gippsland, near Mt Elizabeth. North of the Tinderry Ranges populations of this species become disjunct. There is also an isolated occurrence at the headwaters of the Cotter River. Although its conservation status is not fully known, it does not appear to be endangered.

DISCUSSION:

In general appearance, *A. leucocarpa* closely resembles *A. divaricata* to the extent that Burbridge & Gray (1970) and Willis (1973) placed it under *A. divaricata*. The chief similarity is in the leaf morphology but *A. leucocarpa* differs in its shorter leaf length although its width is often broader (Paterson 1960, Jobson 1988). Both *A. leucocarpa* and *A. aggregata* are white on the undersurface of their leaves due to microscopic papillae and they both have similar leaf anatomies. *Acrotriche aggregata*, however, has a larger leaf size than *A. leucocarpa*. In addition, there are differences between *A. leucocarpa* and both *A. divaricata* and *A. aggregata* in leaf flavonoids and leaf wax alkanes (Jobson 1988). *Acrotriche leucocarpa* can also be distinguished on fruit colour; both *A. divaricata* and *A. aggregata* have red drupes, whereas *A. leucocarpa* has a white drupe.



Fig.1. *Acrotriche leucocarpa*. a—Flowering branch, $\times 1$. b—Flower, $\times 20$. c—Leaf and young buds, $\times 4$. All drawn from type collection.

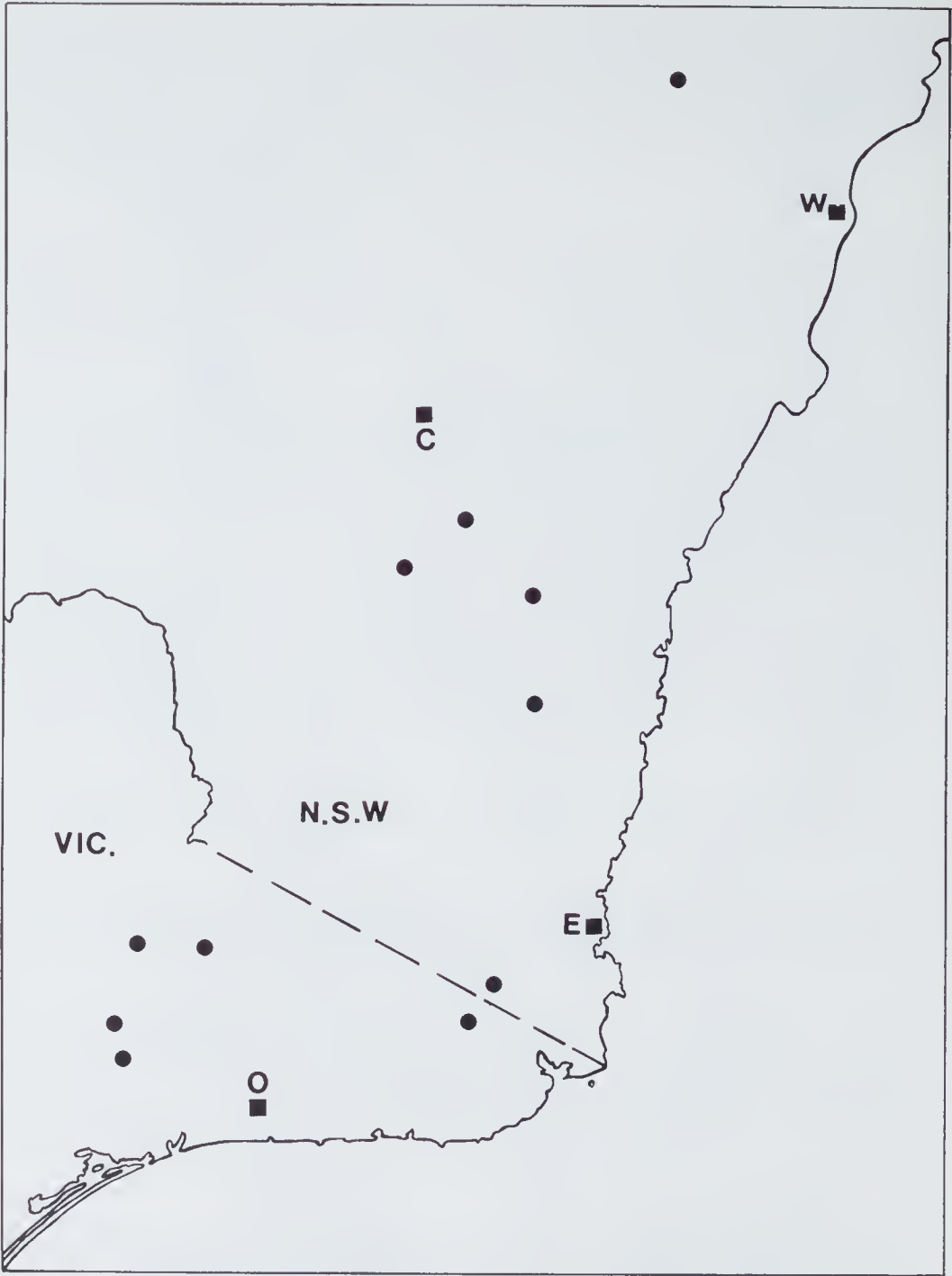


Fig. 2. Distribution of *Acrotriche leucocarpa*. W = Wollongong, C = Canberra, E = Eden, O = Orbost.

The distributions of three species are relatively discreet. *Acrotriche aggregata* has the widest distribution. It extends from northern Queensland (Paluma Range) along the Great Dividing Range to the Blue Mountains in central New South Wales. *Acrotriche divaricata* has a much smaller range and extends from Newcastle through the Blue Mountains to just south of Campbelltown. *Acrotriche leucocarpa*, as stated above, is chiefly a southern New South Wales and Victorian species.

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NEW SPECIES OF *PETROPHILE* R. Br. (PROTEACEAE) FROM WESTERN AUSTRALIA.

by

D. B. FOREMAN*

ABSTRACT

Foreman, D. B. New species of *Petrophile* R. Br. (Proteaceae) from Western Australia. *Muelleria* 7(2): 301–310 (1990). *Petrophile helicophylla* D. Foreman, *Petrophile aspera* C. A. Gardner ex D. Foreman and *Petrophile stricta* C. A. Gardner ex D. Foreman from Western Australia are illustrated and described as new with notes on distribution and ecology. A short note on the application of the name *Petrophile bitemata* is given.

INTRODUCTION

During the preparation of the account *Petrophile* for the *Flora of Australia* several previously undescribed taxa from Western Australia were noted and the opportunity is taken here to formally recognise them. The occasion is also taken to briefly discuss *Petrophile bitemata* and the identity of two taxa described by Sainsbury (1987) in his *A Field Guide to Isopogons and Petrophiles*.

TAXONOMY

Petrophile helicophylla D. Foreman, sp. nov.

Frutex prostratus, c. 0.35 m altus. *Folia* teretia, torsiva, 15–30 cm longa. *Inflorescentia* terminalis, sessilis pedunculata. *Bractae involucales* paucae, subulatae; squamae strobili ± late ovatae. *Flores* albi ad cremicolores ad pallide rosei, extra villosi. *Tepala* c. 35 mm longa. *Pollinis praebitor* sub peniculo turbinatus, peniculus dense tomentosus, apice glabro. *Strobili fructificantes* ± globosi ad elliptici, ad 2.5 cm longi. *Nuces* circulares ad transverse ellipticae, c. 2–2.75 mm longae, 2.5–3.0 mm latae, coma alba ad pallide ferruginea, 5 mm longa, praecipue in marginibus restricta.

TYPUS: Western Australia, 50 km N of South Coast Highway, on old Ravensthorpe Road, 23 November 1985, D. B. Foreman 1195 (HOLOTYPE: MEL 1557967; ISOTYPE: AD, CANB, MEL 1557966, NSW, PERTH).

Prostrate branching and spreading *shrub*, c. 0.35 m tall, up to c. 1.6 m across. *Branchlets* glabrous. *Leaves* glabrous, smooth, terete, spirally twisted, 15–30 cm long, acute. *Inflorescence* terminal, sessile, or with a peduncle up to c. 2.5–3 cm long (excluding the flowers). *Involucral bracts* few, subulate; cone scales broad, ± broadly ovate, ± acute, glabrous. *Flowers* white, creamy white, pale cream-pink or pale pink, villous outside, glabrous and red inside. *Tepals* c. 35 mm long. *Pollen presenter* yellow c. 6–8 mm long, glabrous, turbinate below the brush, brush c. 4.5 mm long, narrow-conical, villous, with a glabrous tip c. 0.5 mm long. *Fruiting cones* ± globose to elliptical, 1.5–2.5 cm long. *Nuts* circular to transverse elliptical, c. 2–2.75 mm long, c. 2.5–3 mm wide, with a persistent beak up to c. 1–1.5 mm long, coma white or pale ferruginous, c. 5 mm long on the margins, shorter and less dense on adaxial surface, adaxial surface dark brown, abaxial surface glabrous, light brown. (Fig. 1)

DISTRIBUTION (Fig. 2):

Scattered in the sandy heathlands north-west of Ravensthorpe and north-east of Jerramungup.

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

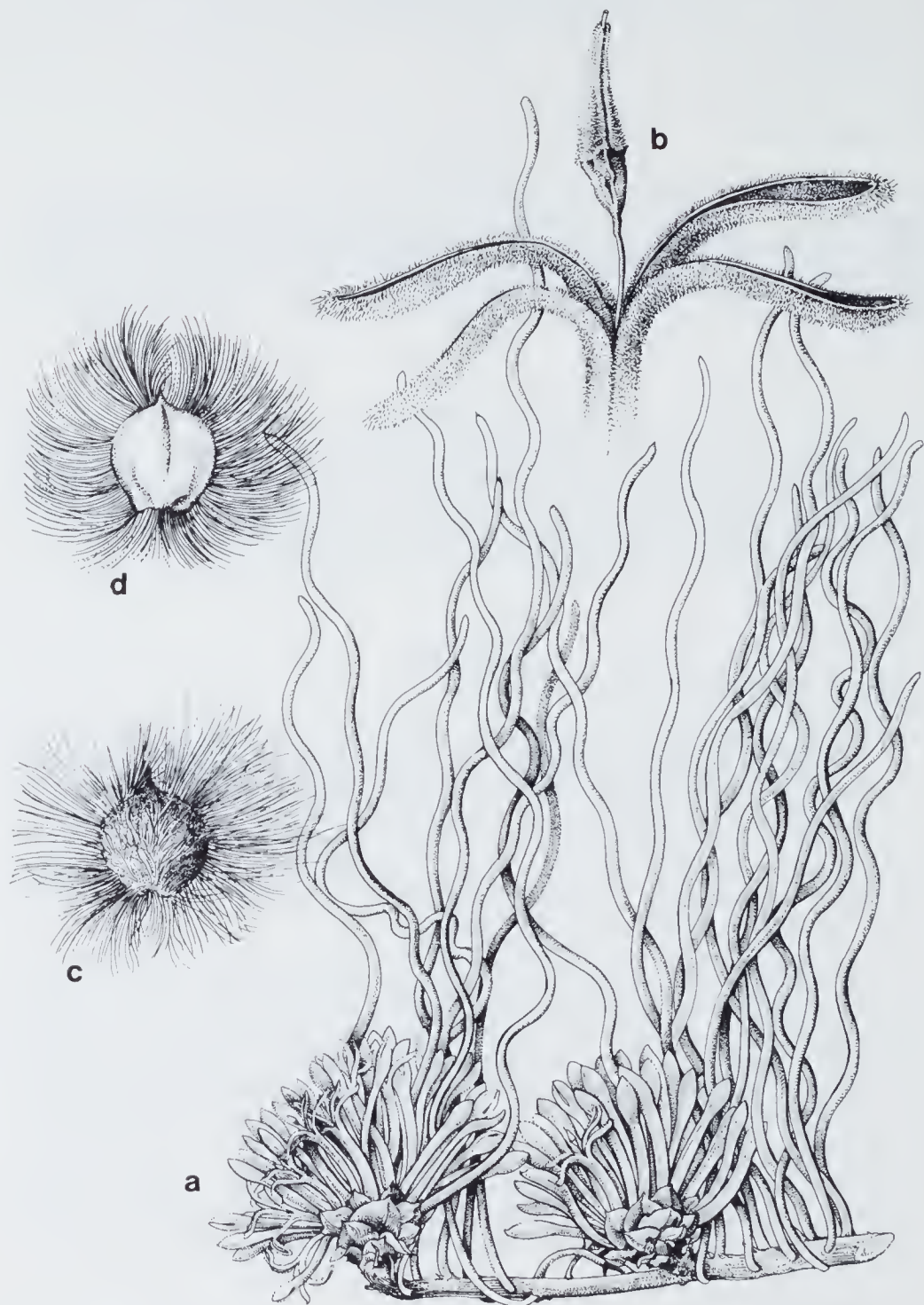


Fig. 1. *Petrophile helicophylla*. a—Flowering branch, $\times 0.75$. b—Limb of perianth and pollen presenter, $\times 5$. c—Adaxial view of fruit, $\times 5$. d—Abaxial view of fruit, $\times 5$. a, b drawn from the holotype; c, d drawn from A. S. George 7676.

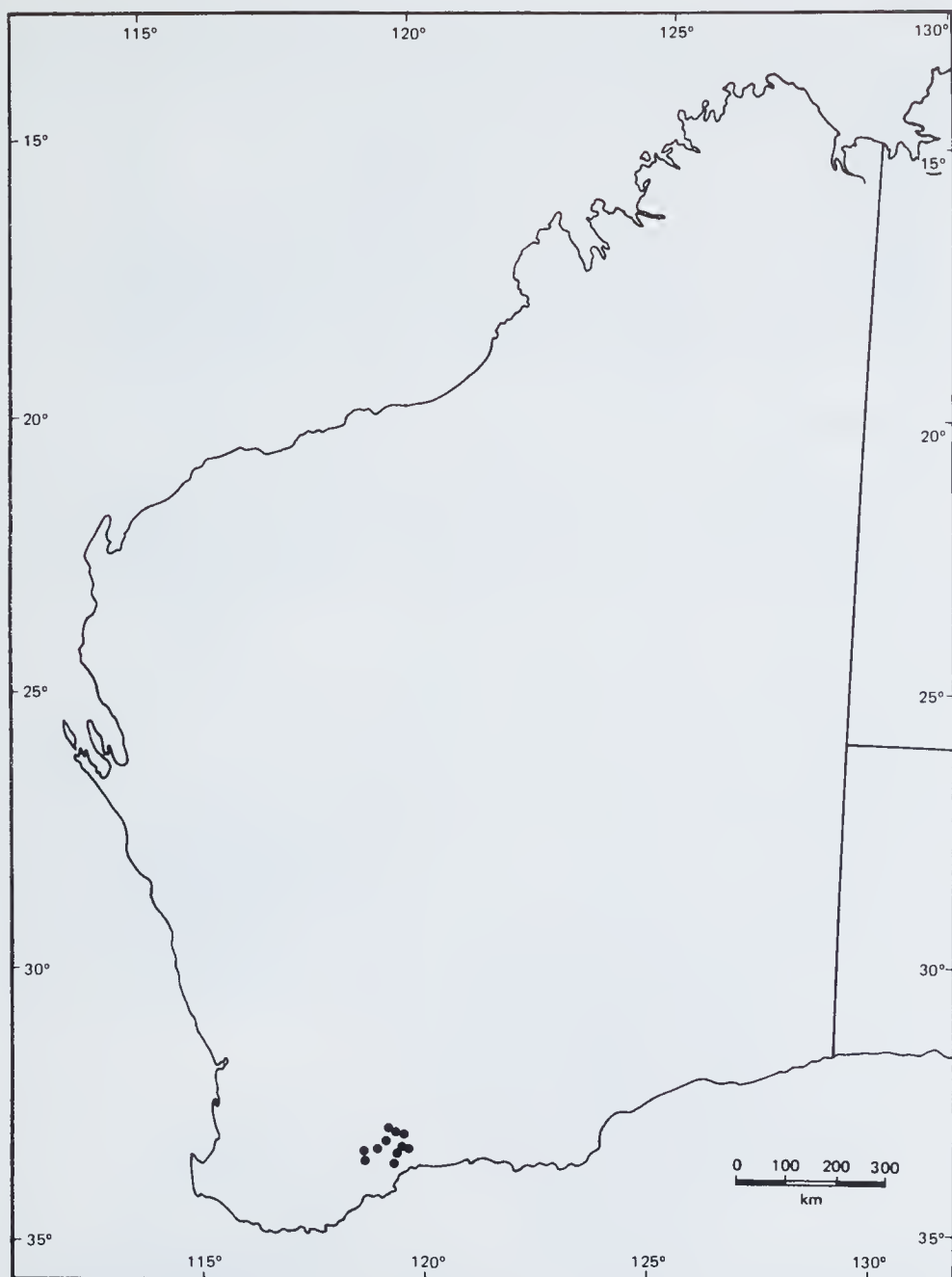


Fig. 2. Distribution of *Petrophile helicophylla*.

ECOLOGY:

Collectors notes include 'in sand, in low heath', 'in sandy clay near salt pans', 'heath on white sand', 'on lateritic heath', 'in sand, with low scrub' and 'well drained, deep white sand in tall open woodland'. Flowers October-February; fruits November-February, June.

NOTES:

The specific epithet refers to the spirally twisted leaves which immediately distinguish it from other allied species such as *P. teretifolia*. The large creamish flowers which are red inside are also rather distinctive.

Some plants are known to occur in the Dunn Rock Nature Reserve, however the conservation status of other populations is unknown.

SPECIMENS EXAMINED:

Western Australia—7 km W of Ravensthorpe, Lake King Road, 20 km S of Lake King, 10.i.1979, B. Barnsley 492 (CBG); 64 km E of Jerramungup, 7.xi.1978, R. J. Cranfield 1095 (PERTH); 14 miles W of Phillips River, 4.xi.1965, A. S. George 7312 (MEL, PERTH); about 33 miles E of Pingrup, A. S. George 7328 (PERTH); 18 miles SE of Lake King on Ravensthorpe Rd, 25.ii.1966, A. S. George 7676 (MEL, PERTH); 15 km N of Ravensthorpe-Ongerup road on Koornong Road, 26.x.1979, N. S. Lander 1092 (MEL, PERTH); 10.5 km N of Jerramungup, 27.vii.1974, K. Newbey 4239 (PERTH); 15 km NNE of Jerramungup, K. Newbey 4604 (MEL, PERTH).

Petrophile aspera* C. A. Gardner ex D. Foreman *sp. nov.

Frutex humilis, 0.2–0.45 m, raro ad 1.3 m, altus. *Folia* exasperata, teretia, 15–30 cm longa, saepe vel ad apicem crispata vel per totam longitudinem parum torta. *Inflorescentia* terminalia sessilia. *Bracteeae involuacrales* lineari-lanceolatae; squamae strobili latae, \pm circulares ad late rhomboideae, apice nonnumquam reflexa. *Flores* pallide-rosei ad albi ad pallide-lutei, extra villosi, dulce redolentes. *Tepala* c. 20 mm longa. *Pollinis praebitor* turbinatus, sub peniculo truncatus, peniculus dense tomentosus ad villosus, apice glabro. *Strobili fructificantes* \pm elliptici c. 2.5 cm longi. *Nuces* late obovatae c. 2.5 mm longae, c. 2.5 mm latae, coma albida ad pallidissime ferruginei, praecipue in marginibus, cum peniculo c. 2 mm longo in base.

TYPUS: Western Australia, 47 km E of Dumbleyung, 27 November 1978, A. S. George 15267 (HOLOTYPE: MEL 1576171; ISOTYPE: CANB, NSW, PERTH).

Low shrub, usually 0.2–0.45 m tall, rarely up to 1.3 m tall. *Branchlets* glabrous. *Leaves* glabrous, roughened, terete, 15–30 cm long, often curled at apex or slightly twisted over their entire length, \pm shortly acute. *Inflorescence* terminal, sessile, 2.5 cm long (excluding the flowers). *Involucral bracts* linear-lanceolate; cone scales broad, \pm circular to broadly rhomboid, acuminate, glabrous, apex sometimes reflexed. *Flowers* pale pink, creamy-white, white, pale-yellow, villous outside, glabrous inside, sweetish scent. *Tepals* c. 20 mm long. *Pollen presenter* 5 mm long, glabrous, turbinate, truncate below the brush, brush 3–3.5 mm long, narrow-cylindrical, densely tomentose-villous with a glabrous tip 0.5–1 mm long. *Fruiting cones* \pm elliptical, up to about 2.5 cm long. *Nuts* broadly obovate, c. 2.5 mm long, c. 2.5 mm wide, with a persistent beak up to c. 1.5 mm long, coma whitish to very pale ferruginous, 4–5 mm long on the margins with a tuft about 2 mm long at the base, adaxial surface with a few scattered longish hairs, abaxial surface glabrous. (Fig. 3)

DISTRIBUTION (Fig. 4):

Scattered over an area between Narrogin and Lake Grace to just north of the Stirling Range.

ECOLOGY:

Collectors notes include 'in sand, in *Banksia*-low open woodland with heath', 'whitish sand, low open shrubland (1–1.5 m) of Proteaceae–Myrtaceae species with emergent mallee eucalypts', 'in gravel heath', 'in sandy laterite, with *E. macrocarpa*-heath association', 'sandplains', and 'sandy gravel'. Flowers August–November; fruits September–October.

NOTES:

The specific epithet refers to roughened texture of the leaves, due to the presence of short hard projections, which distinguish *P. aspera* from *P. teretifolia*. Another feature which distinguishes the former from the latter is a tendency of the leaves to curl at the apex.



Fig. 3. *Petrophile aspera*. a—Flowering branch, $\times 1$. b—Fruiting branch, $\times 1$. c—Pollen presenter, $\times 8$. d—Close up of leaf surface, $\times 6$. e—Adaxial view of fruit, $\times 5$. f—Abaxial view of fruit, $\times 5$. a, c, d drawn from A. S. George 15267; b,e,f drawn from R. Purdie 5342.

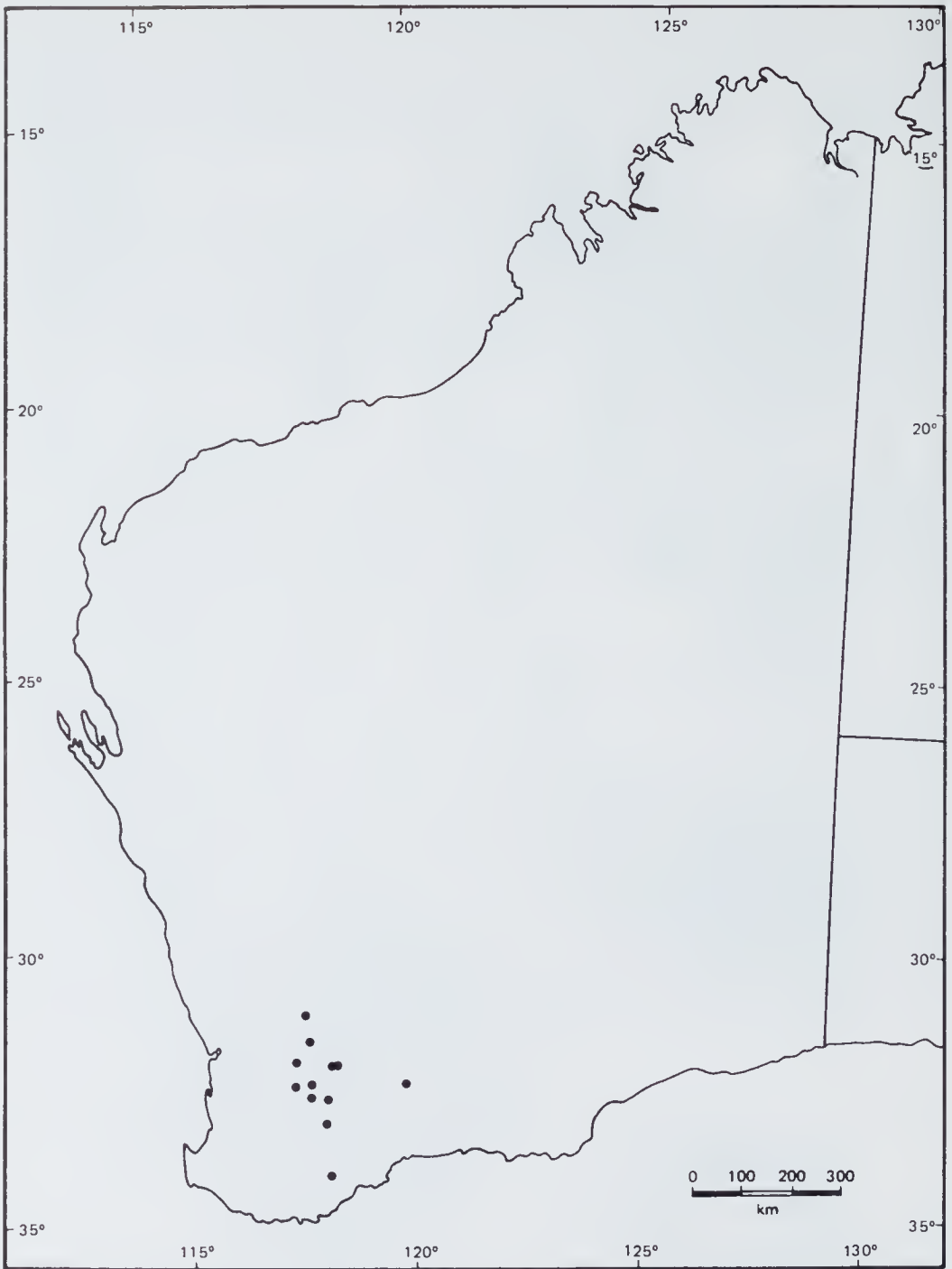


Fig. 4. Distribution of *Petrophile aspera*.

Apart from one collection by C. A. Gardner which indicates a plant 1–1.3 m tall all collections fall within the range 0.2–0.45 m.

This species has been known over a fairly long period and C. A. Gardner recognised it as a distinct entity although never formally validating the name.

Two collections come from reserves, however, the present status of other populations is not known.

SPECIMENS EXAMINED:

Western Australia—10 miles E of Kukerin, 29.x.1962, *J. S. Beard* 2143 (PERTH); Reserve 15637, S of Corrigin, 21.x.1977, *J. S. Beard* 8147 (PERTH); 20 miles W of Lake Grace, 11.xi.1931, *W. E. Blackall* 1329 (PERTH); near Hatter Hill, -.x.1931, *W. E. Blackall s.n.* (PERTH); Salt River Rd, 17 km W of its junction with Chester Pass Road, 17.x.1985, *M. G. Corrick* 9677 (MEL); 33 km W of Lake Grace, 22.xi.1979, *H. Demarz* D7864 (CANB n.v., PERTH); Dudinin, -.x.1934, *C. A. Gardner s.n.* (PERTH); Bilbarin, 18.x.1961, *C. A. Gardner* 13593 (PERTH); SE of Corrigin, 6.ix.1976, *A. S. George s.n.* (PERTH); Wickopin, -.xi.1969, *B. Gorey s.n.* (PERTH); Dongolocking Reserve, c. 48 km E of Narrogin, 15 km SSE of Toolibin, *B. G. Muir* 29 (PERTH); 13.5 km N of Tarin Rock along road to Kulin, 25.ix.1983, *R. W. Purdie* 5342 (CBG); Harrismith, 22.x.1972, *E. Wittwer* W.869 (PERTH).

***Petrophile stricta* C. A. Gardner ex D. Foreman sp. nov.**

Frutex 0.6–1.6 m altus, erectus, effusus. *Folia* teretia, 4.5–13.5 cm longa, simplicia. *Inflorescentia* terminalis, pedunculata. *Bracteeae involucales* lineares, haud persistentes; squamae strobili latae, pagina exterioris velutina. *Flores* rosei ad cremicolores, extra villosi. *Tepala* c. 10–12 mm longa, unumquidque in apice cum projectura breve acuta c. 1 mm longa. *Pollinis praebitor* fusiformis, c. 5 mm longus, hispidus. *Strobili fructificantes* anguste ovati, 2–4.7 cm longi. *Nuces* late ovatae c. 4 mm longae, c. 4 mm latae, coma pallida, ferruginea ad albida c. 6 mm longa, plerumque in marginibus.

TYPUS: Western Australia, c. 40 km N of Hyden on the Mt Walker South Rd, 22 Nov. 1985, *D. B. Foreman* 1164 (HOLOTYPE: MEL 1545866; ISOTYPE: NSW, PERTH).

Shrub, 0.6–1.6 m tall, upright, spreading. *Branchlets* glabrous. *Leaves* glabrous, terete, 4.5–13.5 cm long, unbranched, terminating in a short, sharp point. *Inflorescence* terminal, peduncle 6–12 mm long, c. 1.5–2.0 cm long (excluding flowers) but expanding markedly after flowering. *Involucral bracts* linear, not persisting; cone scales broad, outer surface velvety, inner surface glabrous, tip acuminate, glabrous. *Flowers* pink to cream, villous outside, glabrous inside. *Tepals* c. 10–12 mm long, each topped by a short sharp projection up to c. 1 mm long, glabrous at the tip. *Pollen presenter* fusiform, c. 5 mm long, covered with short stiff hairs. *Fruiting cones* narrow-ovate, 2–4.7 cm long, bracts becoming woody and glabrous. *Nuts* broadly ovate, c. 4 mm long, c. 4 mm wide with a persistent beak up to c. 2 mm, coma pale ferruginous or whitish, c. 6 mm long on the margins, adaxial surface sparsely hairy, abaxial surface covered with short, appressed, whitish hairs. (Fig. 5)

DISTRIBUTION (Fig. 6):

Found mainly in the drier areas of the SW Botanical province and in the south western interzone (Coolgardie botanical district).

ECOLOGY:

Collectors notes include 'in mixed sclerophyll scrub on sandy soil', 'laterite, regrowth after fire: *Acacia*, *Grevillea*, *Casuarina*, *Dryandra*', 'shrubland, on yellow sand over laterite', 'scrub on deep sand', 'open scrub . . . , well-drained, deep yellow sand'. Flowers October–December; fruits of previous year persisting until c. November of the following year.

NOTES:

The epithet refers to the close, straight, upwardly pointing leaves.

Like the preceding species *Petrophile stricta* has long been recognised as a distinct species without ever being formally described. Since many workers appear to know this taxa by the C. A. Gardner manuscript name it seems appropriate to adopt it here.

Petrophile stricta is somewhat similar to *Petrophile semifurcata*, both having terete, upwardly pointing leaves, but differs in having thinner leaves which are always simple, a glabrous style, a distinctly fusiform pollen presenter and fruits with a rather dense coma of pale ferruginous hairs up to c. 6 mm long along the margins. The fruits of *P. semifurcata* have a much less dense coma of shorter hairs.



Fig. 5. *Petrophile stricta*. a—Flowering branch, $\times 1$. b—Fruiting branch, $\times 1$. c—Limb of perianth and pollen presenter, $\times 3$. d—Adaxial view of fruit, $\times 3$. e—Abaxial view of fruit, $\times 3$. a drawn from A. S. George 6038; b-e drawn from holotype.

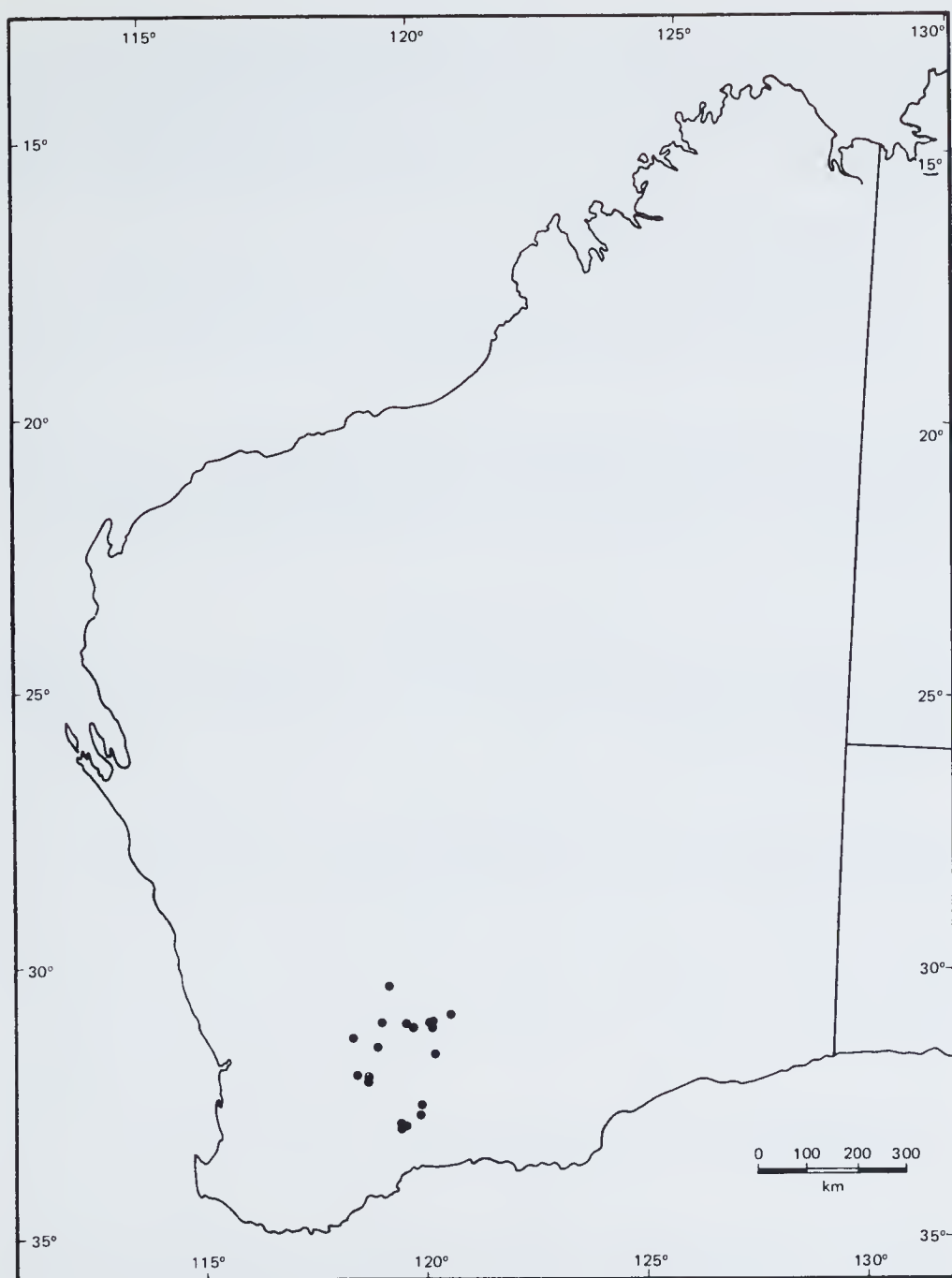


Fig. 6. Distribution of *Petrophile stricta*.

SELECTED SPECIMENS SEEN (Total examined 28):

Western Australia—Mt Holland Road, S of Southern Cross, 2.xi.1931, W. E. Blackall 1253, (PERTH); c. 40 km N of Hyden on Mt Walker South Road, 22.xi.1985, D. B. Foreman 1163 (CANB, MEL, PERTH, TNS); 14 miles W of Boorabbin, 11.xi.1963, A. S. George 6038 (PERTH). Bronti, 242 miles E of Perth, 5.viii.1952, R. Melville 159 (BRI, MEL); 17.5 miles S of Bodallin, 13.xi.1986, B. H. Smith 811 (MEL); 130 km WSW of Kalgoorlie, 30.x.1974, D. J. E. Whibley 4692 (PERTH).

NOTES ON PETROPHILE BITERNATA MEISSNER

Sainsbury (1987) briefly described and provided photographs of two species of *Petrophile* which he designated *Petrophile* sp. from east of Jurien Bay and *Petrophile* sp. aff. *bitermata* from north of Mogumber. As far as I can determine both these entities are referable to *Petrophile bitermata* Meissner. The type locality for *Petrophile bitermata* is rather vague being given as 'between Moore and Murchison rivers'. All the collections I have seen certainly fall within that general area and field work I undertook during 1984 confirm this observation. The collections I have seen all share a number of common features:

viscid cone scales, particularly the outer ones, the inner ones being densely villous with a glabrous tip;
glabrous, yellow, viscid flowers, c. 10 mm long; mostly bitermate leaves;
fruits (where present) of all collections match each other and those of *Drummond 6th collection n. 168*, the type of *P. bitermata*.

SPECIMENS EXAMINED:

Western Australia—between Moore and Murchison Rivers, *Drummond VI 168* (ISOTYPE MEL 1534403); 76 miles (c. 121.5 km) N of Perth on Great Northern Highway, S of New Norcia, 16.ix.1973, A. S. George 11701 (MEL); no precise locality, s. dat., *Drummond s.n.* (MEL 1535911, 1535851, 1534179, 1534180, 1534181); on Brand Highway, 11–14 km N of Eneabba, 3.ix.1984, D. B. Foreman 506 (MEL); Rose Thompson Road, 18 km S of Eneabba-Carnamah Rd, 6.ix.1984, D. B. Foreman 558 (MEL, PERTH); c. 9 km S of New Norcia on Great Northern Highway, 14.ix.1984, D. B. Foreman 701 (MEL).

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BOOK REVIEW

How to know Western Australian Wildflowers. A key to the Flora of the extratropical regions of Western Australia. Part 1. Dicotyledons (Casuarinaceae to Chenopodiaceae). William E. Blackall and Brian J. Grieve. Restructured and Revised Second Edition by B. J. Grieve with assistance from Margaret Lewington. Published by University of Western Australia Press: Nedlands. 1988. 352 + 106 pp., 24 colour plates. ISBN 0 85564 252. Price \$AU50.00.

It is 35 years since publication of the first volume in Blackall and Grieve's classic series "How to Know Western Australian Wildflowers". In the foreword to this revised and restructured Part 1, Robert H. T. Smith, Vice-Chancellor of the University of Western Australia remarks "Since the University of Western Australia acquired the original manuscript of the late William Blackall's great work in 1948, Emeritus Professor Brian Grieve has toiled tirelessly at the task of completing it, preparing it for publication, and later editing revised editions."

This latest volume deals with seventeen families of Dicotyledons from Casuarinaceae to Chenopodiaceae. The remaining Dicotyledons will be dealt with in a revised Part 2, while Monocotyledons, Gymnosperms and Ferns will be treated in Part 5 (both volumes still to come).

The key to the flora begins with a **general classification and key to the families**. The original text of this section has been greatly amplified to over double the size of that in the original Part 1, and well annotated line drawings appear throughout. This key should be very helpful in placing some of the unique and unusual plants, particularly to those unfamiliar with the extraordinary diversity of some of the larger families represented in Western Australia. The author acknowledges the considerable changes in overall classification which have occurred since publication of the first volume and refers particularly to the system advocated by Cronquist. Some of these alternate names for divisions, classes and families are given, but as pointed out in an introductory note to the keys, these changes do not affect the identification of plants using the illustrated key method. The arrangement of orders and families followed, as in previous volumes, is that of Engler (12th rev. edn. Melchior 1964).

Most of the keys to genera and species have been extensively enlarged and drawings re-done to accommodate new species described or species discovered since the original publication. A new feature in this volume is the inclusion of very small black and white photographs among the drawings in the keys. These seem to be of doubtful value, as most are too small, too dark or lacking in contrast to be useful. Their omission would have given a less cluttered appearance and enabled better spacing, and perhaps slightly larger line drawings.

Well over half the main text is devoted to the Proteaceae, one of the largest and most diverse plant families in Western Australia. This section alone should make the book an invaluable asset to students, amateur naturalists and horticulturists, as well as the professional botanist.

The book is greatly enhanced by the inclusion of 24 well reproduced colour plates comprising photographs of 110 individual species. Unfortunately there is no reference to these in either index or text, although a separate list of colour plates precedes this section.

Two sections, not seen in previous volumes, **how to use the book** and **aids to identification** should be helpful, particularly to those unfamiliar with the work. There is also a good glossary with several pages of explanatory figures.

The bibliography is comprehensive and should be particularly useful to those outside universities and herbaria who may not have easy access to, or be familiar with the scope of a botanical library. However there appear to be some omissions; a quick check revealed references to Cronquist (1966), Cronquist (1981) and Dahlgren and Clifford (1981), none of which could be found in the bibliography.

Also included at the end of the main text are additions to the previously published Volumes IIIA, IIIB, and IV (2nd Edn).

This book is a scholarly and meticulous treatment of a difficult subject, presented

with admirable clarity and simplicity. The recommended retail price of \$50 is unfortunately high, particularly considering that 9 of the 17 families dealt with have already been covered in the new *Flora of Australia*. The keys to the Proteaceae are probably the book's greatest attraction, and the expanded and illustrated keys to families will enhance the value of previously published volumes. A paper back edition of the work is foreshadowed and will be welcomed, particularly for use in the field.

M. G. CORRICK

CONTENTS

Volume 7, Number 2	Page
A new species of <i>Cassinia</i> R. Br. (Asteraceae) from South-West Victoria —N. G. Walsh.....	141
New taxa and a new combination in Tasmanian Poaceae —D. I. Morris.....	147
Some species of <i>Cladonia</i> , published by J. D. Hooker & T. Taylor from the Southern Hemisphere —Teuvo Ahti, Soili Stenroos & Alan W. Archer.....	173
The mycorrhizal associations of Australian Inuleae (Asteraceae) —J. H. Warcup.....	179
Notes on Australian Verrucariaceae (Lichenes): 1 —P. M. McCarthy.....	189
<i>Eucalyptus wimmerensis</i> , a new species of <i>Eucalyptus</i> (Myrtaceae) from Victoria and South Australia —K. Rule.....	193
Notes on <i>Hovea</i> R. Br. (Fabaceae): 4 —J. H. Ross.....	203
Two new species of <i>Pomaderris</i> Labill. (Rhamnaceae) from New South Wales —N. G. Walsh.....	207
A revision of <i>Trichanthodium</i> Sond. & F. Muell. ex Sond. (Asteraceae: Inuleae: Gnaphaliinae) —P. S. Short.....	213
A revision of the genus <i>Chthonocephalus</i> Steetz (Asteraceae: Inuleae: Gnaphaliinae) —P. S. Short.....	225
New taxa and new combinations in Australian Gnaphaliinae (Inuleae: Asteraceae) —P. S. Short.....	239
Two new species of <i>Callistemon</i> R. Br. (Myrtaceae) —P. F. Lumley and R. D. Spencer.....	253
<i>Haegiela</i> , a new genus of the Australian Asteraceae (Inuleae: Gnaphaliinae), with notes on the genus <i>Epalties</i> Cass. —P. S. Short and Paul G. Wilson.....	259
The <i>Pomaderris oraria</i> F. Muell. complex in Australia —N. G. Walsh.....	267
New species of <i>Hibbertia</i> Andr. (Dilleniaceae) in New South Wales, Australia —Barry J. Conn.....	289
A new species of <i>Acrotriche</i> R. Br. (Epacridaceae) from South-Eastern Australia —P. C. Jobson and T. Whiffin.....	295
New species of <i>Petrophile</i> R. Br. (Proteaceae) from Western Australia —D. B. Foreman.....	301
Book Review: How to know Western Australian wildflowers. Part 1. Restructured and revised. Second edition. —M. G. Corrick.....	311

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